EDUCATION AND TRAINING AS PART OF AN EXPEDITIONARY COMBAT SUPPORT SYSTEM IMPLEMENTATION STRATEGY

THESIS

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AFIT/GLM/ENS/09-10

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THESIS

Presented to the Faculty

Department of Operational Sciences

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

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March 2009

AFIT/GLM/ENS/09-10

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Abstract

One current venture of the United States Air Force (USAF) is the implementation of the largest ever single-instance of an enterprise resource planning (ERP) system. This project, dubbed Enterprise Combat Support System (ECSS), has the potential to integrate the USAF worldwide supply chain and make transparent the currently cloudy connections between parts, people and processes. Unfortunately, ERP implementations are rife with potential problems and there is no guarantee of successfully implementing ECSS unless the USAF properly manages these problems.

One problem area the USAF must manage is ERP education and training. According to the literature, this area is consistently underestimated. In addition, the education and training success factors are hard to identify and none of the reviewed literature contained a synthesis of these factors. The intent of this study is to help overcome this problem by first identifying the potential education and training success factors. Then, using a multiple case study methodology, the study empirically tests how well the identified factors compare to the methods used by companies implementing an ERP system. Finally, the study compares the proposed USAF ECSS end user training plan to these findings to identify potential problems and help develop recommendations for the implementation team.

To God who strengthened me during this process.

To my wife, daughter and son who gave me the love, understanding and support that made this effort possible. I love you all.

In memory of my grandfather who left us on February 17, 2009. You are missed.

Acknowledgments

I would like to express my appreciation to my faculty adviser, Dr. Jeff Ogden, for his patience, guidance and support throughout the development of this thesis. I would also like to thank my sponsor, the Logistics Transformation Office; especially Mr. John Koczak and Mr. Brent Peaden, who each helped tremendously in their own ways. Additionally, I would like to thank the professionals from Appleton Papers, Avery Dennison, Cisco Systems, NCR and YSI who all generously contributed their time and knowledge. Without the help from the professionals at these fine companies, this research would not have been possible.

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I. Introduction

Overview

> Just as we must transform America's military capability to meet changing threats, we must transform the way the Department works and what it works on. We must build a Department where each of the dedicated people here can apply their immense talents to defend America, where they have the resources, information, and freedom to perform.
>
> Our challenge is to transform not just the way we deter and defend, but also the way we conduct our daily business. Let's make no mistake: The modernization of the Department of Defense is a matter of some urgency. In fact, it could be said that it's a matter of life and death, ultimately, every American's.
>
> Donald Rumsfeld
> Former Secretary of Defense

When he spoke these words on September 10, 2001, Mr. Rumsfeld could not have predicted that events just one day later would end up dramatically proving his theory that the military business processes needed to modernize. Logistics problems, stemming from the military's antiquated business processes, have consistently appeared during the global war on terrorism in Afghanistan and Iraq. As Cottrill (2003) put it, "Reliability of supply lines was one top issue, but another was supply-chain visibility - what orders are in the pipeline and when the goods are being delivered." Peters (2002) added that since there was no way of either tracking supplies' arrival or knowing what container they arrived in, the visibility problem poses a significant risk for the troops on the ground.

To help meet the mandate of the Office of the Secretary of Defense (OSD), and to overcome the problems made evident during the global war on terrorism, the United States Air Force (USAF) launched the Expeditionary Logistics for the 21st Century (eLog21) transformation campaign. Through eLog21 initiatives, the USAF is changing, especially from a logistics standpoint. These changes aim to tear down the traditional stove-piped logistics processes currently in use and replace them with an "anticipatory … cross-functional, integrated (full visibility to all parties), enterprise-wide set of processes" (Dunn, 2007). Perhaps the most critical program to help meet this eLog21 goal is the Expeditionary Combat Support System (ECSS).

According to Dunn (2007), ECSS is an enterprise resource planning (ERP) system that will enhance "the entire Air Force logistics enterprise, to include business process redesign, performance metrics, training, systems, supply chain management, maintenance, change management and more." Several other Department of Defense (DoD) sources within the literature agreed with this viewpoint and explained how ECSS would revolutionize Air Force logistics processes and provide unprecedented views of the overall supply chain (Hamilton, 2007; Cain, 2007; Dredden & Bergdolt, 2007). Thus, successful implementation of ECSS should help solve the main problems of supply reliability and visibility mentioned by Cottrill (2003) and Peters (2002) while modernizing USAF logistics processes.

Problem Statement

Unfortunately, large-scale information technology (IT) implementations like the ERP system that forms the basis of ECSS are fraught with difficulties. Examples of difficult

implementations include even large companies such as Hershey, Whirlpool and Samsonite (Taube & Gargeya, 2005). While many factors play into the success or failure of an ERP implementation, two key factors are end user education and training. The literature is rich with examples of how education and/or training were either critical to the success (Yu, 2005; Grossman & Walsh, 2004; McAlary, 1999) or part of the failure (Taube & Gargeya, 2005; Gattiker, 2002) of an ERP system's implementation. Education and training programs could therefore either 'make-or-break' the USAF's ECSS implementation depending on the execution of these programs.

Because education and training are pivotal to ECSS' successful implementation, USAF decision makers must understand both the risks and requirements associated with ERP education and training in order to minimize implementation problems. This research helps to define these risks and requirements and provides some possible methods to help overcome them. With an understanding of the problems and some potential solutions, senior USAF leaders can make more effective education and training decisions and develop a proper ECSS education and training strategy.

Research Objectives/Research Questions & Assumptions

The objective of this research is to examine the critical ERP implementation education and training success factors, identified in the literature and tested using multiple case study interviews, to help improve the ECSS end user education and training strategy for the USAF touch labor workforce. Understanding these factors should enable USAF decision makers to increase the likelihood of a smooth transition from the current

legacy systems to ECSS. To meet this research objective, the study established the following overarching research question:

- *How should the USAF provide education and training to the touch labor end user employees to best support the ECSS implementation effort?*

The study then developed three investigative questions (IQ) to help guide the research and provide a basic framework for the study:

IQ_1 - *What does the literature define as critical education and training factors needed for a successful ERP implementation?*

IQ_2 - *How do these education and training factors compare to the methods used by industries for 'touch labor' workers while implementing an ERP?*

IQ_3 - *Based on the results of IQ_1 & IQ_2; how well does the proposed USAF ECSS end user training plan compare to the literature and methods used in industry?*

The study had two primary assumptions. The first was that firms who provide touch labor workers with the critical education and training success factors, identified in the literature, while implementing ERP systems would reduce education- and training-related problems. The second assumption was that the USAF would reduce ECSS education- and training-related problems by modifying the end user training plan to the literature and case study findings.

Research Focus

The focus of this research is to determine the best method(s) to educate and train one portion of the workers who will use ECSS, the touch labor end users. Because of this focus on touch labor-level employee education and training (as opposed to corporate-wide, middle- or executive-level education and training), the cases used for the study were selected based on three criteria. First, the company must have recently implemented an

ERP system (within the past 5 years). Second, the company's touch labor-level workforce must use the ERP system on a daily basis. Finally, the study attempted to select companies that had touch labor employees filling maintenance or logistics support functions, as this demographic most closely resembles the touch labor workforce of the USAF.

Methodology

In an attempt to maintain objectivity while examining the research problems and conducting research, the study used a grounded theory paradigm to frame the research in a systematic, scientific inquiry. The three-step cyclical process of grounded theory involves induction, deduction and verification to create, test and verify or reject theoretical assumptions (Patton, 2002). The primary reason for using grounded theory for this study was to reduce the subjectivity to the extent this is possible.

To identify the education and training factors needed for a successful implementation, the study first synthesized the education and training success factors from the literature to develop theoretical propositions about the critical education and training success factors. The study then used a multiple case study methodology (Yin, 1989) to compare these factors to the education and training used at the touch labor-level by industries implementing an ERP similar to ECSS. Finally, the study compared these results to the proposed ECSS implementation strategy to create ECSS education and training recommendations for the USAF Logistics Transformation Office (LTO).

Implications and Summary

As a critical part of eLog21, successful implementation of ECSS will provide the resource visibility, integration and modernization of USAF business processes needed to be

successful in the future. However, implementation of an ERP like ECSS is difficult and many factors play into the overall success of system implementation. This study focuses on understanding two key factors, education and training, in order to provide information needed to help make ECSS end user education and training decisions.

The analysis completed by this study provides an understanding of both what education and training factors have been successful in the past and what methods the USAF should use for their touch labor-level workforce. Using this information, senior USAF decision makers can make choices that help minimize the challenges associated with ECSS implementation. This should increase the likelihood of USAF success when implementing ECSS.

This first chapter outlines the motivation and direction of the research, including providing the research focus, questions that bound the overall research and the methodology used by this study. The second chapter provides a review of selected literature by examining the importance of ERP to the USAF. This chapter first provides a general overview of ERP systems, including the scope, cost, motivation and potential problems of ERP implementations. Then the chapter explains the effects of education and training programs on ERP implementations before identifying the critical education and training success factors and theoretical propositions. The third chapter provides the methodology, including the multiple-case research design, data collection and analysis techniques used to help answer the research questions. The forth chapter provides the results and analysis of the proposition testing, including their links to potential education- and training-related problems and explains the additional findings of the research. The forth chapter concludes with a comparison of the ECSS plan to the findings of this research. Finally, the fifth chapter provides the overall conclusions, recommendations for ECSS education and training efforts, assumptions and limitations of the study, lessons learned and implications for further research.

II. Literature Review

Overview

The purpose of this literature review is to develop an understanding of how education and training factors can affect the implementation of an ERP system. The review begins by providing an explanation of why ERP systems are important to the USAF. It then gives a general overview of ERP systems, including the definition and history of these systems. The study continues by providing some potential scopes and costs of ERP implementations, the motivation for these undertakings and some possible problems faced during the ERP implementation process. Next, the review examines the effects of education and training programs on ERP implementation, including potential education- and training-related problems. Finally, the review concludes by synthesizing the critical education and training success factors found within the selected literature and forming theoretical propositions to establish the basis for the thesis' case study research.

Importance of ERP to the USAF

The global war on terrorism made weaknesses in the military's logistics processes very evident. Lost or insufficient supplies, the inability to track incoming resources and the overall lack of information flow are all flaws in current military logistics (Cottrill, 2003; Peters, 2002). To help overcome these problems, the USAF launched the eLog21 transformation campaign.

One of the main eLog21 initiatives is ECSS. This major initiative "will provide more efficient and less expensive logistics support to the warfighter by transforming … Air Force logistic business processes ... via a methodology called ERP" (RDT&E, 2006).

ECSS then, by definition, is an ERP system and carries the goal of integrating over 400 USAF legacy systems while enabling a global enterprise view of USAF logistics processes (Dunn, 2007). Since initial process blueprinting began in 2007 and ECSS releases are incrementally scheduled starting in 2010 (ECSS Release Services Flyer, 2008), understanding both what an ERP is and how to implement one should be of critical importance to the USAF.

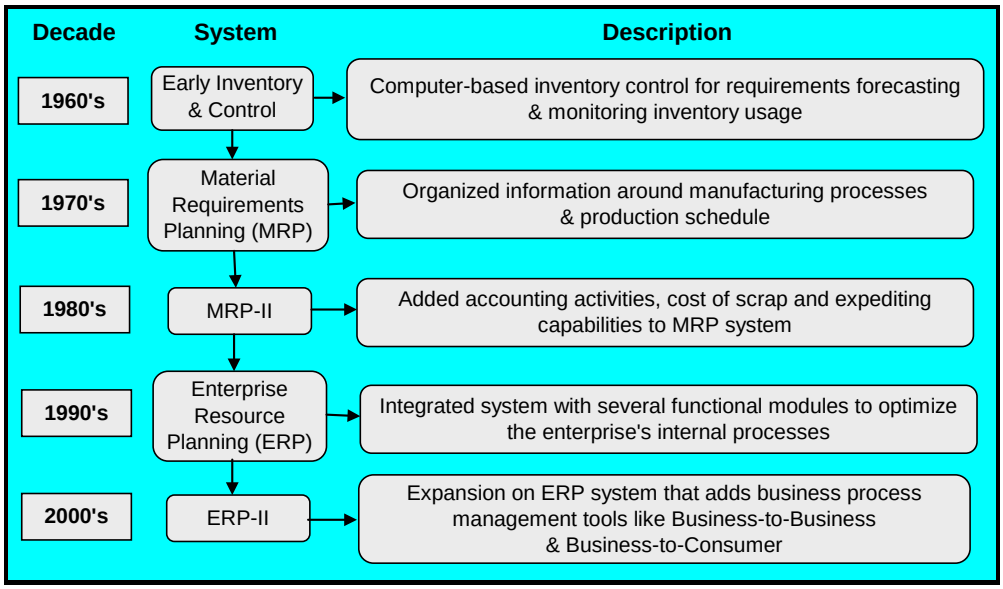
Enterprise Resource Planning (ERP) Systems

The basic definition of an ERP system is a system that allows integrated business processes across an organization using a common database. Usually these systems replace a company's older, legacy systems that either stove-piped or fragmented business processes. Integration is the key to an ERP system. The actual definitions in the literature vary, but the ERP system's overall purpose of integrating a company's business processes remains constant, as seen in the following examples:

- A system providing "integration across (the) enterprise, the inherent best practices for different industries, and the flexibility to meet diverse requirements of multiple organizations" (Wei *et al*., 2005).
- "Systems intended to enable the integration of transaction-oriented data and business processes throughout an organization" (Sanjay *et al*., 2004).
- "Systems designed as integrated sets of software modules linked to a common database, handling functions such as finance, human resources, materials management, sales and distribution" (Robey *et al*., 2002).

Based on a cursory view of the literature, it might appear that ERP systems are relatively new creations. In fact, Al-Mudimigh *et al.*, (2001) explicitly stated that ERP is a 'relatively new phenomenon.' While actual ERP systems may be relatively new from a

business perspective, one would be just as correct to say that ERP systems are the evolution of 40 years of computer-based inventory system innovations starting in the 1960's (Okrent & Vokurka, 2004). Based on the concept that ERP evolved from earlier systems, this study provides a brief history of ERP systems in Figure 1.

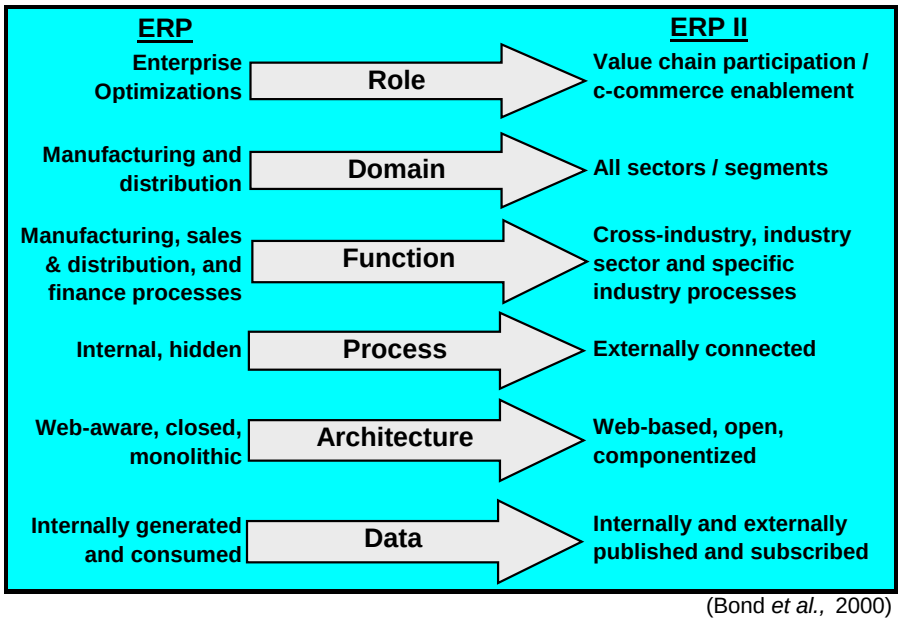


Developed from: Beheshti, 2006; Carver & Jackson, 2006; Moller, 2005 and Okrent & Vokurka, 2004

Figure 1. Evolution of Enterprise Resource Planning Systems

As Figure 1 shows, the predecessors of today's ERP systems started as early computer-based inventory and control systems in the 1960's, then evolved into MRP systems in the 1970's and MRP II systems in the 1980's before actually becoming ERP systems in the 1990's. ERP has since advanced into what researchers have dubbed ERP II (Fawcett, Ellram & Ogden, 2007). With the exception of this latest mutation, the DoD literature is thick with detailed descriptions of this transformation, including Rosa (2002), Mueller (2003) and most recently, Strachan (2008). These sources are excellent resources for anyone desiring a more in-depth look at ERP system evolution from the early systems up to ERP system creation.

Other than Hill (2007), the study found no mention of ERP II in the selected DoD literature. As ERP II truly is a recent adaptation of ERP, this is not surprising. However, given the study previously defined ERP and to prevent an apparent gap in this study's review of the literature, it seems appropriate to provide a simple explanation of ERP II by way of contrasting it with ERP. To accomplish this, the study found several academic and trade references that highlighted the differences between ERP and ERP II, specifically, Beheshti (2006), Moller (2005) and Bond *et al.* (2000). Indeed, Figure 2, adapted from Bond *et al.* (2000), clearly shows the differences between ERP and ERP II.



(Bond *et al.,* 2000)

Figure 2. Comparison of ERP and ERP II Systems

An ERP II system varies from an ERP system primarily in that it allows integration with outside companies and consumers (Beheshti, 2006; Moller, 2005; Bond *et al.*, 2000). From a DoD standpoint, moving from an ERP to an ERP II system might entail integrating not only the USAF logistics processes, but also all DoD logistics functions under one extremely large system. However, although Hill (2007) described this as an

"ideal ERP system," he also added that because the military services are currently working on separate and unique systems, "the best that can be hoped for is the successful implementation of the current projects and the future integration of these projects." As an analysis of the benefits of ERP II over ERP is beyond the intended scope of this research, the remainder of the literature review and research refers only to basic ERP systems.

Scope of ERP Implementations

The scope of an ERP implementation involves the level of company integration of the ERP software. Given the name, 'Enterprise' Resource Planning and the earlier ERP definition examples from the literature, one might naturally think an ERP system's scope would always span an entire organization. However, this is not always the case. The literature reported ERP implementations as wide as an entire company's global sites to as narrow as a single division within a company or a single site, such as a manufacturing plant (Bozarth, 2006; Ferratt *et al.*, 2006; Fisher & Bradford, 2006; Gattiker, 2002; Parr & Shanks, 2000).

The literature did attempt to explain this almost counter-intuitive limited implementation of an ERP system, such as only within a single division or site, by citing ERP implementation failure as the primary cause. This undoubtedly was the reason behind what both Fisher & Bradford (2006) and Gattiker (2002) reported where excessive costs, setbacks and outright system failures resulted in permanent partial ERP implementations. There could be other reasons for these limited implementations, such as company politics, limited need or some other reason not considered by the author of

this research. However, no other causes for limited ERP implementation presented itself in the selected literature of this review.

Unlike these incomplete implementations, the USAF has no plans for ECSS to be a limited or partial ERP implementation. Rather, the vision is to have the system integrate the logistics processes of the entire worldwide enterprise into a single database to provide real-time asset visibility and control (Strachan, 2008; Dunn, 2007; White & Bergdolt, 2007). Indeed, the scope of ECSS is so large that Hartman (2007) labeled it the "world's largest, single instance ERP with over 250,000" users. None of the selected literature countered this claim or came anywhere near 250,000 users for a single implementation, lending credence to the belief that the size and scope of ECSS will be on a record-breaking scale.

Cost of ERP Implementations

The integration promised by ERP systems often allows companies to reduce or eliminate legacy systems that are either outdated or fragmented (Guido *et al*., 2007). However, the cost of ERP implementations is often extremely high in terms of both time and money. In fact, on a per company basis, the average reported cost of an ERP implementation was $15 million with 45% of the companies implementing an ERP spending at least $10 million and some larger firms spending over $300 million (Ferratt *et al.*, 2006; Willis *et al*., 2001). All told, Welch & Kordysh (2007) estimated that over the previous 10 years (1997 – 2007) companies paid more than $70 billion for ERP software and spent between six months and four years implementing these systems.

Both the time and cost of implementing an average ERP system pale in comparison to the enormity of the USAF ECSS implementation project. The estimated cost of ECSS varies depending on the source, but falls somewhere between $535 and $628 million over an estimated 7 years (CSC, 2006; Morales, 2006; RDT&E, 2006). Thus, much like a civilian company, the USAF has a huge stake in its ERP system and faces a huge loss if the system fails. As Strachan (2008) put it, "the Air Force does not have sufficient resources to allow ECSS to fail."

Motivation for ERP Implementations

With ERP system implementations having the potential to tie up a significant portion of a company's capital for a large amount of time, one may wonder why a company would consider the transition from a legacy to an ERP system. The basic ERP system definitions, provided earlier in this study, give some clues to a company's motivation such as 'integrated business processes,' 'flexibility,' and 'best-practices.' However, these words all describe outcomes of, rather than motivation for, ERP implementation.

Based on the literature, the actual motivation appears to be the competitive advantage and cost saving that a company expects to gain as a result of the improved integration, flexibility and best practices offered by an ERP system (Bozarth, 2006; Muscatello & Parente, 2006; Al-Mashari & Al-Mudimigh, 2003). This underlying profit motive helps the massive cost of ERP implementation make sense in terms of the long-range strategic goals of the company.

However, since the USAF is not a profit-motivated organization, the traditional motivations for implementing an ERP might not hold true. Indeed, the motivation for ECSS implementation may be significantly different from that of a civilian corporation and therefore create a limitation by making comparisons of ECSS implementation to a traditional ERP implementation more difficult. To explore this possibility, the study developed a composite of the motivations for implementing ECSS from the DoD literature and compared these to their civilian equivalents as seen in Table 1.

Table 1. ECSS Implementation Motivation

USAF Motivator	Civilian Equivalent	Adequate Match?	Literature Support
Improve Warfighter Support by Revolutionizing Logistics Processes & Integrating Legacy Systems	**Increase Competitive Advantage**	*Assumption:* Improving warfighter support increases the competitive advantage of the USAF over foreign military forces	Strachan, 2008 Dunn, 2007 ECSS FAQ, 2007 Hamilton, 2007 Hartman, 2007 Kelly, 2007 White, 2007
Reducing Costs of Supporting Global Logistics Operations	**Cost Savings**	This appears to be an adequate match with no assumptions required	Strachan, 2008 ECSS FAQ, 2007 Hamilton, 2007 Hartman, 2007 Kelly, 2007 White, 2007

As seen in Table 1, the USAF does not have the same implementation motives as a non-governmental company. However, implementing an ERP, such as ECSS, will still provide the USAF with civilian equivalent benefits of increasing competitive advantage (through improved warfighter support) and reducing costs (of supporting global logistics operations). Although the motivations are not exactly the same, they are similar enough to the ones that motivate profit-seeking companies to allow for practical comparisons of ERP implementations.

Potential Problems of ERP Implementations

The bulk of the reviewed literature clearly stated that ERP implementations are nothing if not problematic. Parr & Shanks (2000) described ERP implementations using terms such as "'endurance tests', 'fiascos', 'living to tell about it' and 'war stories'" and included that 90% of all ERP implementations were either late or over-budget. Taube & Gargeya (2005) added that 70% of these projects failed to reach full implementation, even after years of trying. Based on the problems faced by many ERP implementations, Kumbholz *et al.* (2000) summarized that ERP implementation "projects were, on average, 178% over budget, took 2.5 times as long as intended and delivered only 30% of promised benefits."

The literature contained many types of potential problems faced during ERP implementations, but this review focused only on two main types: technical and organizational problems. Technical problems occur when the ERP system fails to work as expected, such as with completely broken, inadequate systems or with systems that fail to replace legacy systems and/or require workarounds (Fisher & Bradford, 2006; Gattiker, 2002). These problems revolve around factors such as ERP modules, process mapping, system integration level, and implementation strategy.

On the other hand, organizational problems occur when companies fail to support the implementation through factors like top-level support, user involvement, change management, and ***education and training*** (Guido *et al.*, 2007; Grossman & Walsh, 2004; Gattiker, 2002). Organizational problems can occur even with the implementation of a 'perfect' ERP system because, in reality, these problems have little to do with the ERP

system itself. Rather, the majority of these problems come from the changes to the organizational culture and processes brought about by the ERP system.

As previously stated, there are many potential factors within both the technical and organizational problems. Understanding the potential for and causes of these technical and organizational problems is an important part of an ERP implementation because failing to manage either problem can negatively affect an ERP system's implementation. However, a discussion of all the factors within both the technical and organizational problems is beyond the intended focus of this study. Therefore, rather than attempting a summary discussion of all potential problem factors, this literature review now shifts to a thorough discussion of two facets of the organizational problem, education and training.

Effects of Education and Training on ERP Implementations

In one study of 30 manufacturing firms, Duplaga & Astani (2003) concluded, "The number-one (implementation) problem for organizations of all sizes was lack of ERP training & education…followed by lack of in-house expertise in ERP." These words are a warning that adequate employee education and training are critical to the success of an ERP system's implementation. Conversely, inadequate employee education and training can have severe negative implications for a company's ERP system, both during implementation and beyond.

Indeed, as Wheatley (2000) explained, "ERP failures are not systemic. Training is the important factor". Wheatley followed this statement with reasons for ERP training failures and included that, "the traditional view of training may blind the unwary to its

significance and to the tightly woven links that exist between training, change management (education) and staff adequacy." The selected literature strongly supported that education and training adequacy were major factors in ERP implementations as shown in Table 2.

Table 2. Effects of Education and Training Adequacy on ERP Implementations

	Adequate Education and/or Training is Critical to Success of ERP Implementation	Inadequate Education and/or Training is a Major Cause of Problems During ERP Implementation
Literature Support	Tsai & Hung, 2008	Dredden & Bergdolt, 2007
	Welch & Kordysh, 2007	Hill, 2007
	Ferratt *et al.* , 2006	Jackson & Carver, 2006
	Muscatello & Parente, 2006	Scott, 2005
	Yu, 2005	Grossman & Walsh, 2004
	Akkermans & Van Helden, 2002	Jones & Price, 2004
	Oxendine & Hoffman, 2002[1]	Al-Mashari & Al-Mudimigh, 2003
	Robey *et al.* , 2002[1]	Duplaga & Astani, 2003
	Rosa, 2002	Mueller, 2003
	Wheatley, 2000[1]	Gattiker, 2002
	McAlary, 1999[1]	Weston, 2001
		Krumbholz *et al.,* 2000

1. These articles cite both effective and inadequate 'education and/or training' as causes of ERP success or failure respectively

With the importance of education and training clearly shown in the literature, one would expect education and training to be major parts of an integrated ERP implementation strategy. However, echoed throughout the literature were quotes like "training was minimal" (Gattiker, 2002), "training is consistently an under-budgeted item…(and is)…often the first item cut" (Scott, 2005), "lack of training and education…contributed to the failure" (Al-Mashari & Al-Mudimigh, 2003) and "training is the stepchild of most software implementations" (Grossman & Walsh, 2004). These phrases invariably were followed by how the lack of education and training caused problems with (or failure of) the ERP implementation.

While training is often poorly planned or under-funded, this is only part of the problem. Another is the lumping of 'education and training' into the generic term, 'training.' Worse, companies often use the term 'training' correctly and put the term 'education' under the ambiguous terms 'communication' or 'change management' (Okrent & Vokurka, 2004; Robey *et al.*¸ 2002). The result is that the education piece of 'education and training' often gets lost in the overall training effort.

This is a problem because ***education*** and ***training*** are two separate and distinct parts of the overall ERP learning process and they both have unique and important purposes. The first part, ***education***, provides the "why, who and where" (Wheatley, 2000) portion of the ERP learning process. Education helps create end user expectations about the ERP system and provides the end-users with the 'big-picture' view of an ERP implementation.

Education is so important that the literature often calls the education portion of the ERP learning process either the most important training factor (Yu, 2005; Nah *et al.,* 2004; Gattiker, 2002; Robey *et al.,* 2002; Wheatley, 2000) or a critical training factor (Dredden & Bergdolt, 2007; Jones & Price, 2004; Al-Mashari & Al-Mudimigh, 2003; Willis *et al.*, 2001). This is because education has a major effect on end users' perceptions, acceptance and usage of the ERP system. In a study of 14 firms implementing ERP systems costing between $2 and $400 million, Yu (2005) found that the "effectiveness of the education program" was a statistically significant predictor of the "degree of realism of user pre-implementation expectations," the "degree of data accuracy," and the "degree of system stability." In addition, Yu found that the "effectiveness of the education program" was

"significantly more important than the 'effectiveness of the training program,' revealing that merely training users how to operate systems is insufficient."

Yu (2005:119) added that,

> Education aims to teach the general ERP concepts, such as how ERP affects the work of individuals…why and how end-users are disturbed by the business process reengineering…how to deal with conflicts created in implementation, how to adjust individual working processes and get familiar with the new system after post-implementation, and much more.

Unfortunately, as previously mentioned, by burying education under the term 'training' or throwing it under the umbrella of communication or change management, it becomes very easy to forget. However, forgetting this important portion of the users' learning often leads to the ERP implementation problems or failures described in the literature (Al-Mashari & Al-Mudimigh, 2003; Gattiker, 2002; Robey *et al.*, 2002). Of course, sometimes the problem is not forgetting to educate, but rather the effectiveness of the education. This sentiment came across clearly in a Wheatley (2000) quote from IDC senior research analyst, Cushing Anderson, "No matter what application an organization is implementing, they are usually better at the keystroke and transaction training than they are at the business-and-people process education."

The second part of the overall ERP learning process, ***training***, involves the hands-on, how-to use the ERP system portion of the learning process. Training can be computer- or equipment-based, face-to-face or online, on-the-job, paper-based or any combination of these and more. Training is a critical step because it provides the skills and confidence

necessary for the end-users to operate the new ERP system (Yu, 2005; Wheatley, 2000) and is a vital 'go-live' prerequisite.

Training is so critical before going live that the literature explicitly states, "Successful ERP implementation depends on successful training" (McAlary, 1999). Failing to give employees enough training before an ERP system goes live is a recipe for disaster. As one employee who went through an implementation that lacked enough training put it, "I felt like we jumped off a cliff and did not know what would happen" (Krumbholz *et al.*, 2000). To address both the ***education*** (business-and-people process) and ***training*** (keystroke and transaction) halves of the ERP learning process, the next section provides a listing of the potential education- and training-related problems found in the literature.

Potential Education- and Training-Related Implementation Problems

The previous section provided ample general information about how education and training can affect ERP implementations. However, it failed to provide many specifics about the types of implementation problems that are directly related to education and/or training. Understanding this relationship is important because it allows implementation mangers to adapt education and/or training to meet the problems the implementation is currently facing. Table 3 provides an overview on the types of problems that can occur due to failures in education and/or training, including a brief description of each type of problem.

Table 3. Potential Education- and Training-Related Problems

Potential Problem	Education-Related	Training-Related
Failure to Meet User Expectations (System doesn't work as employees thought it would)	X	
Sabotage (Employees take direct actions to 'break' system)	X	
Lack of User Understanding (Reasons for ERP system not communicated to users)	X	
Low Employee Morale (Employees dissatisfied with how change is managed)	X	X
Resistance to Change (Employees don't want to use ERP system)	X	X
Lack of User Acceptance / Buy-In (Employees don't believe ERP system will work)	X	X
Lack of In-House Expertise (High-level knowledge transfer from 3rd party vendors to in-house employees poorly accomplished)		X
Improper System Use / Workarounds (Employees either use the ERP system incorrectly or bypass using the system)		X
Low User Proficiency (Training did not meet end user's needs to allow them to effectively use ERP system)		X
Sources		
Al-Mashri & Al-Mudimigh, 2003	**Elbanna, 2007**	
Harris, 2003	**Ngai et al., 2007**	
Parr & Shanks, 2000	**Scott & Vessey, 2000**	
Welch & Kordysh, 2007	**Wei et al., 2005**	
Willis et al. 2001	**Yu, 2005**	

It is important to note that very few of these potential problems will occur alone. For example, resistance to change and low user proficiency can lead to improper system use and workarounds (Wei *et al.,* 2005). In addition, other problems, like failing to meet user expectations, may have peripheral causes such as technical ERP system problems rather than failed user education. However, this study assumed proper management of the causes external to education and/or training and only explored the impact of education and training effectiveness on problems. With an understanding of the importance of education and training, the study continues with a synthesis of the critical education and training success factors found in the literature.

Critical Education and Training Success Factors

IQ_1, identified in Chapter 1 was, "*What does the literature define as critical education and training factors needed for a successful ERP implementation?*" No one study within the examined literature provided an answer to this question. To help overcome this problem, the author conducted a qualitative inductive analysis (Patton, 2002) of 30 sources within the selected literature that identified education and/or training as critical. From these sources, the author attempted to identify and synthesize the factors, based on type (education or training), needed to make user ERP learning successful.

This was no easy task especially since, as previously mentioned, the education and training terms are often either lumped together as one or the education factors are lost under the umbrella of either change management or communication. To help prevent the vague use of the education term from becoming a limitation, the author used many sources to enhance the validity of the identified factors. In addition, the author attempted to identify the 'What,' 'Why' and 'How' components of each education success factor.

Based on the literature, the study identified a total of eight education and training success factors, three for education and five for training. The author then created a table from these education and training success factors to illustrate the factors and identify the literature support. Table 4 represents the critical ERP education and training factors found by the author and provides a synopsis description and the literature support for them. Following the table, the study provides a quick explanation of the education- and training-related success factors found in Table 4.

Table 4. Critical ERP Education and Training Success Factors

Education Related Success Factors		
Success Factor	**Description**	**Literature Support**
1. Prepare Employees for Change	Employee 'resistance to change' starts with uncertainty. Educating employees on, **What** job changes will happen, **Why** job changes are necessary and **How** changes will benefit them helps reduce uncertainty and build ERP system acceptance and buy-in.	**2**, **3**, **7**, **8**, **15**, **18**, **20**
2. Explain New Processes	ERP systems attempt to integrate systems and tear down 'silo' mentality. Employees need to understand **What** changes to business process will be, **Why** these changes are necessary and **How** they fit into the overall process.	**3**, **4**, **5**, **6**, **7**, **10**, **12**, **13**, **14**, **17**, **20**, **21**, **22**, **28**, **30**
3. Prepare Employees for Glitches	Within even the best ERP implementations some problems arise. Employees need to understand **Why** the potential for problems exists, **How** to identify problems and **What** to do to get problems fixed.	**2**, **11**, **14**, **18**, **23**
Training Related Success Factors		
Success Factor	**Description**	**Literature Support**
4. Tailored to Job	Training should be tailored to the employees' needs, not generic. This helps the employees practice how to accomplish their jobs in the new system and helps reduce training-related problems during 'go-live'.	**3**, **4**, **8**, **10**, **12**, **13**, **14**, **15**, **16**, **23**, **24**, **27**
5. Super-User Trainers	A group of competent and willing SME employees should be professionally trained or work closely with the implementation team to develop the skills necessary to train the other end-users.	**4**, **9**, **13**, **17**,**18**, **24**, **26**, **29**
6. Support Training with User Manuals	User manuals, especially job specific, step-by-step procedures provide employees with a 'safety-net' in the event of training gaps or memory failure	**10**, **17**, **18**, **19, 23**, **24**
7. Train Just-in-Time before 'Go-Live' date	Employees need hands-on training and must be fully trained prior to 'go-live'. Training too early or failing to provide enough training before 'go-live' can result in implementation problems like low user proficiency.	**4**, **10**, **20**, **23**, **25**, **29**
8. Perform Follow-up Training	Training should not be a 'one-time' thing. Jobs change and the ERP system adapts throughout the system's life-cycle. Training must continue and adapt to these changes.	**1**, **3**, **5**, **7**, **8**, **19**, **22**, **23**, **30**

Supporting Literature Key	
1. Dredden & Bergdolt, 2007	**2.** Elbanna, 2007
3. Ngai et al., 2007	**4.** Welch & Kordysh, 2007
5. Ferratt *et al.,* 2006	**6.** Furumo & Melcher, 2006
7. Muscatello & Parente, 2006	**8.** Dowlatshahi, 2005
9. King, 2005	**10.** Scott, 2005
11. Wei et al., 2005	**12.** Yu, 2005
13. Jones & Price, 2004	**14.** Nah et al., 2004
15. Al-Mashri & Al-Mudimigh, 2003	**16.** Harris, 2003
17. Kumar et al., 2003	**18.** Tchokogue et al., 2003
19. Umble et al., 2003	**20.** Gattiker, 2002
21. Robey et al., 2002	**22.** Al-Mudimigh *et al.,* 2001
23. Weston, 2001	**24.** Willis et al., 2001
25. Krumbholz et al., 2000	**26.** Parr & Shanks, 2000
27. Scott & Vessey, 2000	**28.** Wheatley, 2000
29. McAlary, 1999	**30.** Stamps, 1999

Education-Related Success Factors.

The three education-related success factors address the *People, Process* and *Technology*-related needs for ERP education. For example, success factor *1 – Prepare Employees for Change* addresses people-derived education needs such as employee uncertainty over how their jobs will change. Success factor *2 – Explain New Processes* addresses the process-derived education needs, such as how the ERP system will integrate processes. This helps prepare employees to break the 'silo' mentality and understand how they fit into the overall business processes. The final education success factor, *3 – Prepare Employees for Glitches*, helps employees understand potential technical issues that can arise during an ERP implementation.

Training-Related Success Factors.

The training-related success factors fall into five categories answering 'What,' 'Who', 'How', 'When' and 'How Long'. The first category, 'What,' includes success factor *4 – Tailored to Job.* This factor addresses what to train, i.e. whether the training should be specific to the employee's job or simply explain generalized use the new system. The 'Who' category includes success factor *5 – Super-User Trainers*. This factor addresses whether vendors using vendor-provided training or in-house employees using a train-the-trainer philosophy should train end users.

The 'How' category includes success factor *6 – Support Training with Manuals*. Since this success factor is a ***support*** for training, during the case study interviews the study also explored how to conduct primary training and presents this as an additional finding. The 'When' category includes training success factor *7 – Train Just-in-Time*

before 'Go-Live' date and involves the overall timing of end user training. The last category, 'How Long' includes the final training success factor *8 – Perform Follow-up Training.* This category looks at whether the training should be one-time or more continuous and adaptable to ERP system changes and end user needs.

Development of Theoretical Propositions

To establish a grounded theory of analysis within this research, the study then developed eight theoretical propositions based on the critical education and training success factors gleaned from the literature. The study created these propositions using the induction method of theory development via the findings from the literature review. Thus, the literature review became the exploratory phase of this research. This enabled the deduction and verification stages of grounded theory during data collection, analysis and conclusions and thus was both appropriate and necessary (Strauss, 1987).

Education Propositions

The education propositions developed during this study revolve around the people-, process- and technology-motivated education needs of ERP end users. Three education propositions were developed; one each for the people-, process-, and technology-motivated education needs. In general, these propositions involved the education the end users receive about how the ERP system will affect them, their work, the business processes and the potential problems that can occur during both during and after the ERP implementation.

Proposition One – People-Motivated Education.

One might mistakenly believe that ERP implementations are simple changes in IT systems. In actuality, these implementations are often a "life-changing experience for everyone involved" (Willis *et al.*, 2001). Dowlatshahi (2005) found that when a company explained how the new system would benefit them, "the employees had little resistance or difficulty in accepting the new system." Conversely, Al-Mashri & Al-Mudimigh (2003) partially attributed a failed ERP implementation to not providing employee education about job changes and concluded that, "management failed to give sufficient credence to its employees' distress that was generated by massive change." Thus, the author created the following proposition:

P_1: Address Employees' Readiness for Change (People-Motivated Need):

> *ERP implementations will reduce education-related problems when a company provides education on what job changes will occur, why the job changes are necessary and how they benefit the employees*

Proposition Two – Process-Motivated Education.

ERP systems often dramatically change business processes and understanding both the process changes and how employees fit into these new processes is an important part of an ERP education program. The reviewed literature had many examples of this idea. Ngai *et al*. (2007) provided that, "Organizations should provide a customized training and education programme that provides employees with tools and practical experience needed to integrate new processes, roles and responsibilities." Welch & Kordysh (2007) echoed this sentiment, explaining that users need to understand "both system-level transactions and business processes so they (can) grasp the bigger picture of

what (is) happening upstream and downstream and how their actions (affect) others." Thus, the author created the following proposition:

P_2: Address Process Changes (Process-Motivated Need):

> *ERP implementations will reduce education-related problems when a company educates employees on the new business processes, including what changes will happen, why the changes are necessary and how the employees' work fits into the overall process*

Proposition Three – Technology-Motivated Education.

As the literature clearly pointed out, no ERP implementation happens without some unexpected problems. Weston (2001) explained that a key part of managing an ERP implementation is to prepare employees for potential problems and explain what to do after they encounter these problems. Along the same lines, Tchokogue et al. (2003) described how Pratt & Whitney provided education sessions that included, among other things, foreseeable implementation problems and contact information for the network support team. Thus, the author constructed the following proposition:

P_3: Prepare Employees for Glitches (Technology-Motivated Need):

> *ERP implementations will reduce education-related problems when a company educates employees on potential problems with the ERP implementation, including why problems happen, how to identify the problems and what the employees can do to get them fixed*

Training Propositions

The training propositions created during this study revolved around factors including what to train, who should train, how to support training, when to conduct training and how long to train. The study developed five training propositions, one for

each of these factors, bringing the study's total proposition count to eight. In general, these propositions involved job specific training, when and how long to conduct system training, and supporting facets of user training, such as train-the-trainer programs and the use of training manuals.

Proposition Four – What to Train.

The first training proposition developed during this study involved identifying what training the end user requires. The need for specific training was prevalent in the literature, including Harris (2003) who suggested that end users have "customized training needs" that companies must meet for an implementation to be successful. Scott (2005) mirrored this thought and concluded that, "Role-based training would provide knowledge integration and better mapping to users' needs." With this in mind, the author developed the following proposition:

P_4: Training Tailored to Employee's Job (What to Train):

> *ERP implementations will reduce training-related problems when a company applies a training program that is not generic and focuses on that employee's actual job*

Proposition Five – Who Should Train.

The next proposition developed for this study involved 'who' should provide training to the end-users. There was strong literature support of the train-the-trainer philosophy for end-user training. Indeed, Willis *et al*. (2001) greatly supported this idea, stating both that, "The train-the-trainer approach is, by far, the most cost effective method of training." and "A well-trained super user (trainer) can save the company tens of thousands in consulting and training dollars in the future." A side benefit of using the

train-the-trainer approach is that ERP system knowledge becomes internal to an organization rather than remaining external with the vendors.

The train-the-trainer methodology requires two steps. First, the trainer must be a subject matter expert (in their area) and receive full, in-depth training on the ERP system. These super users then develop end user training materials and serve as primary end-user trainers. King (2005) described this two-stage training strategy with, "First, assign the most knowledgeable people to work with consultants in implementation. Then have them serve as trainers for other, less-knowledgeable client employees." This was the same strategy supported by Tchokogue *et al*. (2003) in a case study of a successful ERP implementation by Pratt & Whitney where 110 employees were initially developed as internal trainers. These employees then provided comprehensive training of both tasks and process changes to the end-users of the system. Thus, the author created the following proposition:

P_5: Train the Trainer Program Used (Who Should Train):

> *ERP implementations will reduce training-related problems when a company fully trains some qualified, willing and able employees to train the remaining workforce*

Proposition Six – How to Support Training.

Supporting training with training manuals was another common theme in the literature. Weston (2001) considered providing training manuals to end users an imperative, stating, "Training must be supported by system documentation. This documentation may include specific examples showing how to perform a specific function, what to do when a certain error message is received, how to use help routines,

and so forth." Scott (2005) explained the benefits of training manuals with, "Users appreciated having a printed manual to help them do their jobs…(especially)…step-by-step guides to carrying out the task, and, to a lesser extent, illustrations of screens from the ERP software." This led to the development of the following proposition:

P_6: Training Manuals Used (How to Support Training):

> *ERP implementations will reduce training-related problems when a company develops job specific training manuals to support employee use of the ERP system*

Proposition Seven – When to Train.

Timing the end user training is by no means a simple process. As McAlary (1999) explained, "If you train too early, users may forget how to perform their new tasks by the time the system goes live. Training can take place as late as two weeks before the beginning of the implementation cycle." On the other hand, training too late is a recipe for disaster. As Weston (2001) explained, setting an arbitrary 'go-live' date "before users are fully trained and ready is a death trap." Describing a failed implementation, Gattiker (2002) added that, "Before implementation and immediately after the software 'went live', plant-level personnel received very limited training." This failure in training was partly responsible for implementation problems including ineffective system use and employee workarounds. Thus, the study developed the following proposition:

P_7: Timely Training (When to Train):

> *ERP implementations will reduce training-related problems when a company completes training just <u>before</u> an implementation's 'go-live'*

Proposition Eight – How Long to Train.

The length of the training program refers to whether the training is one-time or continuous. This decision has a direct impact on whether or not training receives updates as changes to the ERP system happen. The literature leaned towards continuous training. One source supporting this idea was Muscatello & Parente (2006) who concluded, "Training and education cannot be shorted even after the 'go live' date of an ERP implementation." Another was Ngai *et al*. (2007) who felt, "Training is regarded as one of the critical resources of an organization that must be managed on an on-going basis." With this idea in mind, the final proposition was developed:

P_8: Follow-up Training Provided (How Long to Train):

> *ERP implementations will reduce training-related problems when a company provides follow-up/continuous training to address changes from the initial training*

Identification of Research Gaps in the Literature

The literature provided excellent accounts of what occurred during past ERP implementations, including the overall critical success factors for these implementations. However, this study found no single research that specifically presented or synthesized the critical education and training success factors for an ERP implementation as shown in Table 4. Rather, the research tended to present some of each of the factors within Table 4, and then explained how these factors affected ERP implementation. This study attempted to fill this gap in the research in three ways. First, by compiling the education and training success factors found in the literature into Table 4. Then, the study created propositions to create a theoretical framework to compare how well these factors fit into

actual ERP implementations using a multi-case study methodology. Finally, based on the results of the case studies, this study analyzes the proposed ECSS education and training plan to provide recommendations for the USAF ECSS implementation strategy that will ultimately test the results of these findings.

Summary

To develop an understanding of how education and training factors can affect the implementation of an ERP system, this chapter first described the importance of ERP to the USAF. The study explained that because ECSS is an ERP system and is currently ongoing, the USAF must understand both what an ERP system is and how to implement one. Next, the chapter provided the background of ERP systems, including the definition and some history of these systems. This chapter then explained the scope of ERP implementations, including the enormous span of ECSS and the cost related to ECSS implementation.

Following this, the chapter compared the motivation of private company ERP implementations to the USAF motivation for ECSS and found them very similar. Potential ERP implementation problems were then explored, particularly the technical and organizational problems and some factors that could cause them. Based on the research focus, the chapter then chose from these problems two components in particular, education and training, and provided a thorough description of both the education and training factors and their effects on ERP implementation. The study also provided a list of potential education- and training-related problems inherent in ERP implementations.

The chapter then conducted a qualitative research analysis of the literature to identify and synthesize the critical education and training success factors for use in the study's case interviews. From these factors, the study presented eight propositions to develop the theoretical framework for the data collection, analysis and conclusions. Finally, the chapter concluded by explaining the gaps within the literature, specifically the lack of any one study presenting and then testing the critical education and training success factors needed to implement an ERP system.

III. Methodology

Overview

The purpose of this chapter is to explain the techniques used to address the research questions pivotal to the overall objective of this research. The chapter starts with a restatement of this research objective before describing the paradigm and methodology that frame the research phases. The chapter then discusses the two research designs used for the study. Next, the chapter explains the sources and collection of data and then explains the analysis methods the study used to create the findings and conclusions found in chapters IV and V. Finally, the chapter concludes with an explanation of the study's strategy for achieving reliability and validity.

Restatement of Research Objective

As stated in the first chapter, the objective of this research is to examine the critical ERP implementation education and training success factors, identified in the literature and by case-study industries, to help create an ECSS education and training strategy for the USAF touch labor workforce. With this goal in mind, the methodology in this chapter simply provides a strategic 'roadmap' to help reach this objective.

Research Paradigm

When developing a research strategy, one imperative is to establish a paradigm, or frame of reference, for looking at the observations (Babbie, 2005). By deliberately selecting a paradigm, rather than merely using one's experience and preconceived notions as a guide, a more objective, and therefore more valid, study is possible. To

this end, the study chose a grounded theory paradigm to frame the research in a systematic, scientific inquiry.

Grounded theory is a process that "emphasizes steps and procedures for connecting induction and deduction through the constant comparative method, comparing research sites, doing theoretical sampling, and testing emergent concepts with additional fieldwork" (Patton, 2002). The three-step cyclical process of grounded theory involves induction, deduction and verification. During the induction phase, initial theories are developed. The deduction phase uses the findings from the induction phase and conducts further field studies to develop implications for verification. Verification involves either qualifying or negating the theoretical propositions developed during the induction phase (Patton, 2002; Strauss, 1987). Grounded theory requires all three phases and, as Strauss (1987) puts it, "All three aspects of inquiry (induction, deduction and verification) are absolutely essential."

Methodology of Research Phases

After deciding on the research paradigm, the next imperative is to select the methods used to conduct the study. As the primary questions revolve around 'how', 'why' and 'what', and the focus is on "a contemporary phenomenon within some real-life context," (Yin, 1989), a qualitative multiple-case study research strategy with an explanatory research focus is appropriate (Ellram, 1996). This research strategy and focus is a good fit for the deduction and verification phases required by the grounded theory paradigm selected by this study. The overall methodology the researcher used for this study is seen in Figure 3.

	Phase of Research		
	Induction ⟷	Deduction ⟷	Verification
Purpose of Phase	Develop theoretical propositions	Examine theoretical propositions against observations	Validate or reject propositions and examine rival interpretations
Research Focus	Exploratory	Explanatory	
Investigative Questions Answered	**IQ_1**. What does the literature define as critical education and training factors needed for a successful ERP implementation?	**IQ_2**. How do these education and training factors compare to the methods used by industries for 'touch labor' workers while implementing an ERP?	**IQ_3.** Based on the results of IQ1 & IQ2; how well does the proposed USAF ECSS end user training plan compare to the literature and methods used in industry?
Research Strategy Used	Inductive Analysis and Creative Synthesis	Multiple case study	

Developed from: Patton, 2002; Yin, 1989 and Strauss, 1987

Figure 3. Methodology of Research Phases

Research Design

The purpose of a research design is to describe the "logical sequence that connects the empirical data to a study's initial research questions and, ultimately, to its conclusions" (Yin, 1989). Due to the mixed methodology required to meet the goals of the grounded theory used for this study, a two-part research design was necessary. The following paragraphs explain the two research designs:

Induction Phase.

As the primary research for this study will be a multiple-case study, developing initial theories and concepts prior to beginning these studies is vital (Yin, 2003). However, although the study identified many critical success factors in the literature, this study found no single synthesis of the critical education and training success factors in the selected literature. Therefore, the main purpose of the research design in the

induction phase was to develop the initial theoretical framework from which to build the remainder of the research.

With this understanding, the researcher used the literature review to comply with this goal. The researcher chose the reviewed literature, specifically the literature that identified education and/or training as critical factors for this phase. Using the literature to conduct an inductive analysis and creative synthesis research strategy (Patton, 2002), this phase provided initial answers to IQ_1 and, in addition, provided the theoretical propositions used to conduct the deduction and verification phases.

Deduction and Verification Phases.

The deduction and verification phases of research design follow standard qualitative multiple-case study procedures (Yin, 2003; Patton, 2002; Yin, 1989). Although one potential criticism of qualitative studies is that they lack structure, Yin (1989) presented five components required for a case study research design in an effort to provide the structure needed to help meet this criticism. The five components of a case study's research design are:

1) A Study's Questions.

Research Question. To focus the research on a primary objective, the study created the following overarching research question:

- ***How should the USAF provide education and training to the touch labor end user employees to best support the ECSS implementation effort?***

Investigative Questions. The study then developed the three following investigative questions to help guide the research and provide a framework for the study:

IQ_1 – *What does the literature define as critical education and training factors needed for a successful ERP implementation?*

IQ_2 – *How do these education and training factors compare to the methods used by industries for touch labor workers while implementing an ERP?*

IQ_3 – *Based on the results of IQ_1 & IQ_2; how well does the proposed USAF ECSS end user training plan compare to the literature and methods used in industry?*

2) A Study's Propositions, if any

As Yin (1989) points out, although the 'how' and 'what' questions of this (or any) study illustrate what the overall research attempts to answer, they "do not point to what you should study." Yin added that creating propositions moves the researcher in the right direction by both creating a theoretical reflection on the data and giving the researcher some insight on "where to look for relevant evidence." Thus the goal of the induction phase, as previously stated, was to provide the theoretical framework from which the deduction and verification phases could build. To this end, the researcher created the following eight propositions:

P_1: Address Employees' Readiness for Change (People-Motivated Need):

ERP implementations will reduce education-related problems when a company provides education on what job changes will occur, why the job changes are necessary and how they benefit the employees

P_2: Address Process Changes (Process-Motivated Need):

ERP implementations will reduce education-related problems when a company educates employees on the new business processes, including what changes will happen, why the changes are necessary and how the employees' work fits into the overall process

P_3: Prepare Employees for Glitches (Technology-Motivated Need):

ERP implementations will reduce education-related problems when a company educates employees on potential problems with the ERP implementation, including why problems happen, how to identify the problems and what the employees can do to get them fixed

P_4: Training Tailored to Employee's Job (What to Train):

ERP implementations will reduce training-related problems when a company applies a training program that is not generic and focuses on that employee's actual job

P_5: Train the Trainer Program Used (Who Should Train):

ERP implementations will reduce training-related problems when a company fully trains some qualified, willing and able employees to train the remaining workforce

P_6: Training Manuals Used (How to Support Training):

ERP implementations will reduce training-related problems when a company develops job specific training manuals to support employee use of the ERP system

P_7: Timely Training (When to Train):

ERP implementations will reduce training-related problems when a company completes training just before an implementation's 'go-live'

P_8: Follow-up Training Provided (How Long to Train):

ERP implementations will reduce training-related problems when a company provides follow-up/continuous training to address changes from the initial training

To help develop a full picture of a company's implementation, the study supported these propositions with questions regarding 'who', 'what', 'when', 'how' and 'how long'. For example, during each interview, the respondents were asked questions such as, "When to start an education program?" or "What methods were used for the education effort?" or "How did you train your end users?" These questions brought out several unexpected insights that the study discusses during Chapter IV Analysis and Results.

3) A Study's Unit of Analysis

The third component provided by Yin (1989) defines the bounds of the case study. This framework develops around the initial research questions and propositions. Although theoretically the unit of analysis could be anything, as Patton (2002) puts it, "The key issue in selecting and making decisions about the appropriate unit of analysis is to decide what it is you want to be able to say something about at the end of the study." Figure 4 illustrates the study's choice of unit of analysis.

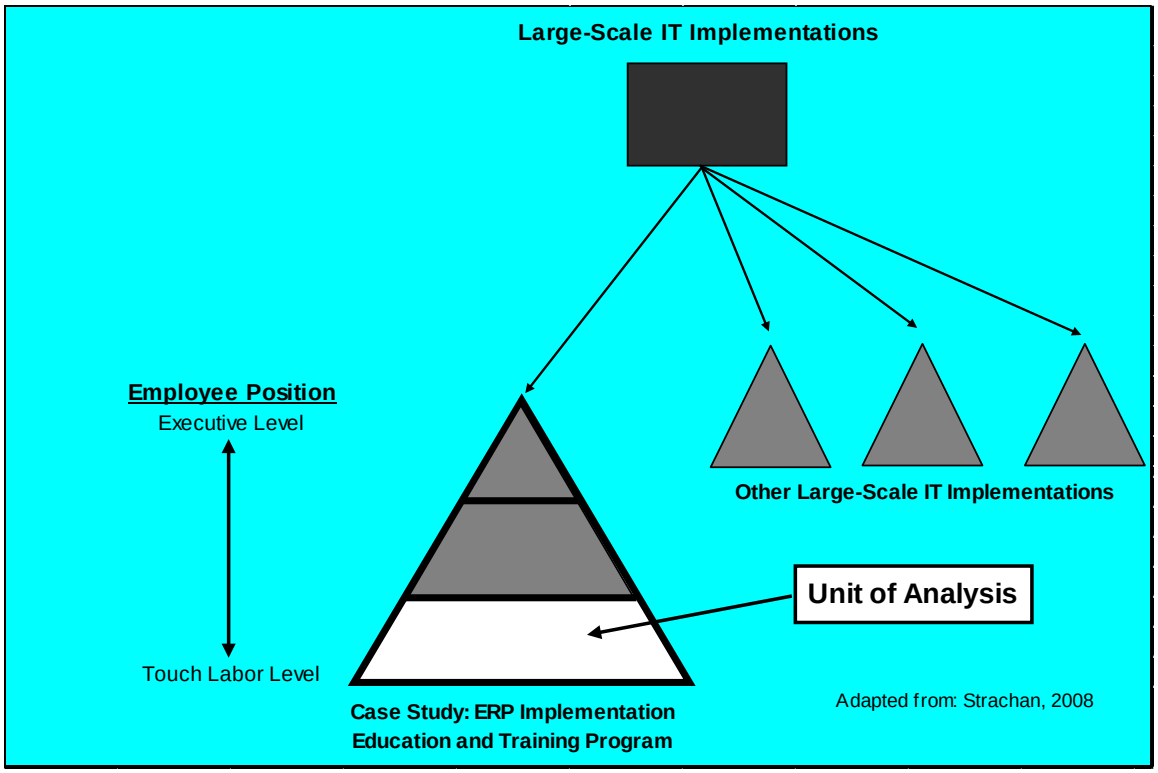


Figure 4. Unit of Analysis

As seen in Figure 4, although the study could have focused on all large-scale IT implementations, the primary unit of analysis for this study was ERP implementations. Specifically, this study's unit of analysis was the education and training programs used

for the touch labor end users of an ERP system. This unit formed the basis for the study's findings, analysis and conclusions.

4) The Logic Linking the Data to the Propositions

The fourth component of a case study involves how the study uses the obtained data to support the study's hypothetical propositions. This study used pattern matching in hopes of finding several cross-case matches related to the theoretical propositions. To help support the findings of the pattern matching and, to "invite the reader to make their own analysis and interpretation," (Patton, 2002), the study included many relevant quotations from the case studies. At the same time, the study reviewed the patterns in the data to attempt to find any rival theories that could also explain the findings (Patton, 2002; Yin, 1989). This helped the author reject any propositions that either lacked support or found justification in a rival factor.

5) The Criteria for Interpreting the Findings

As Yin (1989) points out, "There is no precise way of setting the criteria for interpreting (qualitative) types of findings." However, as explained by Yin (1989) and strongly supported by Patton (2002), using rival theory to attempt to negate the theoretical propositions is one method to maintain the rigorous design needed for a qualitative study to increase its credibility. Rival theories are akin to a null hypothesis in quantitative studies and serve the purpose of 'testing' the theoretical propositions. However, unlike with quantitative statistical analyses, a qualitative analysis of patterns usually does not usually provide definite conclusions. Rather, the researcher attempts to find and explain the "best fit" for the patterns found in the data (Patton, 2002).

Sources and Collection of Data

With the study's unit of analysis of the education and training programs used for the touch labor employees during ERP implementations, the study next developed criteria for the sources and collection of data. The study used civilian industry sources provided by the Logistics Transformation Office (LTO), based on the following criteria for selection:

1. Company recently implemented an ERP system (< 5 years ago)
2. Company has a touch labor workforce that uses the ERP system in daily operations
3. Company's touch labor workforce provides a maintenance or logistics support function for the company

The overall logic behind the choice of using recent ERP implementations with daily touch labor support and/or maintenance users was this type and level of worker strongly resembles the primary workforce in the USAF. By endeavoring to match the demographic of the USAF touch labor workforce, the author attempts to strengthen the case to generalize the findings of the study to the USAF's ECSS implementation.

Using the previously defined criteria, the LTO initially contacted six individual companies to determine their willingness to participate in the study. The five companies that agreed to participate all met the selection criteria. The researcher sent these company's both an introduction and research summary letter via email (see Appendix B for the introduction and research summary letters). Table 5 lists the releasable information about the selected companies and explains the overall fit with the selection criteria.

Table 5. Selected Cases

Company Name	Industry Type	Approx. Number of Employees	ERP Implementation within 5 years?	'Touch Labor' workforce uses ERP?	'Touch Labor' works in a Mx or Support function?
Appleton Papers Inc.	Specialty Paper Manufacturing	2,400	Yes (2004)	Yes	Yes
Avery Dennison	Pressure Sensitive Technology Manufacturing	30,000	Yes (In-progress)	Yes	Yes
Cisco Systems Inc.	Network Solutions	67,000	Yes (4 between 2006-2008)	Yes	Yes
NCR Corp.	Point-of-Sale Solutions and Consumables	23,000	Yes (2005)	Yes	Yes
YSI Inc.	High-tech Manufacturing	320	Yes (2004)	Yes	Yes

For the case study portion, the data collection method was the long interview method developed by McCracken (1988), using interview techniques outlined by McCracken, Yin (1989) and Patton (2002). The approach the study used was a standardized, mostly open-ended interview; with allowances to go 'off-subject' should the opportunity present itself (see Appendix C for the interview guide containing these questions). These interviews were conducted face-to-face (or via Cisco telepresence) to allow the interviewer to see and react to nonverbal cues and establish a better rapport with the people providing the data (Patton, 2002). In addition, the researcher digitally recorded each interview to help ensure accuracy. As people were involved in the collection of the data about the company's education and training programs, the study used a standard ethics protocol letter that was nearly verbatim from McCracken (1988) (see Appendix D).

Background Information on Individual Case Study's ERP Implementations

This section provides a general overview on the studied cases, including the company's industry type, size and interview information. In addition, the background information provides other general information about the company's use of the ERP system including the percentage of processes tied into the overall system and some typical uses of the system within the company. After the interview process, the researcher transcribed the recorded conversations and then developed this information into individual case studies. To enhance face and construct validity, each individual case study was sent to the respondents for approval and correction (if needed) prior to inclusion in this research.

Appleton Papers, Inc.

"Appleton creates product solutions through its development and use of coating formulas, coating applications and encapsulation technology. The company produces carbonless, thermal, security and performance packaging products" (Appleton, 2009). Appleton employs approximately 2,400 people, about 80% of which are 'touch labor' employees. Appleton initiated a company-wide ERP implementation, dubbed 'Project Venture' in January 2001. The case study focused on the implementation efforts used for the 440 employees at Appleton's West Carrollton mill. The author conducted interviews at the mill on November 19, 2008. Two members from management who were involved in the implementation effort, one from IT and the other from production, with a combined 29 years of experience at Appleton participated in the interviews.

Appleton uses the ERP system for approximately 90% of the processes and systems in the company. The current system replaced an older ERP system that was reaching obsolesce and 2-3 significant legacy systems. Beyond simply replacing older systems, Appleton needed the new ERP instance to support other businesses that Appleton had acquired and to build ERP-based best business practices into Appleton's operations.

Appleton uses management/administration, finance/accounting, transportation, warehouse, inventory, purchasing/supplier, production and engineering ERP modules. The 'touch labor' at Appleton interacts daily with these ERP modules using both PC stations (with manually entered and automatically generated data) and scan guns (in the finishing and shipping area). Some examples of system use include planning work and production schedules, managing warehouse inventory & shipping and determining purchase requirements based on planned production.

Avery Dennison Corp.

Avery Dennison Corp. is a global manufacturer of printers, bar codes, self-adhesive products and pressure sensitive technologies. Avery employs 30,000 people in 200 facilities worldwide, about 60% of which are 'touch labor' employees. Avery completed a multiple-site ERP implementation in 2002. However, because no implementation manager was available from Avery's 2002 ERP effort, this case study focused on the implementation efforts currently in use or planned for seven sites in Avery's European divisions in Denmark, the Netherlands, Belgium, France and Germany.

The author conducted interviews at Avery's Miamisburg, OH plant on November 13, 2008. A member of the core management team involved in the European implementation effort with four years of experience at Avery participated in the primary interview. The author also interviewed an end-user who worked at the Miamisburg plant during its 2002 ERP implementation. Although the European implementation is still ongoing and no outcome information is readily available, Avery has completed several successful ERP implementations, including the Miamisburg plant in 2002, and this study hoped to draw from that experience to help determine applications for the USAF.

Avery installed the systems currently in the European division in 1996. These systems are character-based systems that do not communicate with each other and act as business stovepipes within Avery. The new ERP system enables integration, not only within the planned sites but also with Avery's global ERP system. Thus, the involved locations will see a dramatic change in the way they do business. As the interviewed manager explained, "It's huge because the legacy systems are stand alone systems, and we have seven instances of them. So now we're going to eliminate all seven of them and we're going to have one fully integrated system so they can see their entire business from a global perspective."

At sites where Avery has already implemented ERP systems, they use management /administration, human resources, finance/accounting, inventory, purchasing/supplier, production, engineering, order management and quality ERP modules. The 'touch labor' workforce at these Avery sites interacts daily with the ERP modules using PC stations. Some examples of system use include finance planning,

accounts payable, inventory management, order entry, production planning and manufacturing management.

Cisco Systems, Inc.

Cisco Systems, Inc. is a leader in network solutions including hardware, software and other infrastructure. Cisco employs more than 67,000 people in over 85 countries around the world. Eleven primary ERP instances support Cisco's global network. These "ERP instances evolved over a period of 14 years, starting in 1994, and are still evolving". This case study focused on the general education and training flows and methods Cisco has standardized to help ensure success at 'go-live'. The researcher interviewed two members of Cisco's IT management team with extensive ERP implementation experience (12 and 13 years respectively) via Cisco telepresence on December 18, 2008.

The ERP systems at Cisco are primarily Oracle based and started with manufacturing, order management and accounting functions. This relatively small start expanded to more than 30 ERP modules and 11 primary ERP instances over Cisco's 14 years of implementations, updates and upgrades. Specifically, Cisco implemented three primary ERP systems from 1994-2000 and then four primary systems during 2001-2005 and again during 2006-2008. These systems provide quoting/ordering, finance/ accounting, planning, manufacturing, production, engineering, product lifecycle management, human resources, purchasing, inventory and customer management ERP modules among others.

Cisco's ERP systems tie into approximately 70% of the business processes and systems in the company. The 'touch labor' at Cisco is "the primary ERP user with most of the management and sales teams using systems that are a few steps away from the primary ERP systems." These individuals interact with the ERP systems through PC stations. Some examples of system use include customer service operations, sales management duties, manufacturing operations, logistics, human resources and IT teams who support these systems.

NCR Corp.

NCR Corp. is a leader in point-of-sale solutions including ATMs, self-checkouts, document imaging and associated supplies and consumables. NCR currently employs approximately 23,000 people at various locations around the globe. NCR initiated a global ERP implementation in 2001. This case study focused on the education and training efforts used at NCR's Systemedia plant in Morristown, TN.

The Morristown plant employs approximately 350 individuals, with around 85% operating in touch labor positions. The author conducted interviews at the Morristown plant on September 9, 2008. Two members from management who were involved in the implementation effort, one from both the production and warehouse sides of the plant with a combined 36 years of experience at NCR participated in the primary interview. The author also interviewed an end-user who worked at NCR during the implementation to obtain overall impressions about the education and training programs.

NCR's ERP system ties into approximately 90% of the processes and systems at the Morristown location. According to the interviewed managers, the current system

replaced hundreds of legacy systems. This system contains many ERP modules including finance/accounting, warehousing, inventory, purchasing, production, and planning and order entry. The touch labor workforce at NCR interacts daily with these ERP modules through a combination of PC stations and scan guns. Some examples of system use include order processing, receiving, order pulling, inventory management, production planning, scheduling, and shipping.

YSI, Inc.

YSI, Inc. is a manufacturer of instrumentation used to measure various water parameters. YSI employs 320 people, about 33% of which are 'touch labor' employees. YSI initiated a multiple location ERP implementation, in December 2002. This case study focused on the efforts used during a synchronous implementation at YSI locations in Ohio, Massachusetts, New Jersey and Baton Rouge. The author conducted interviews at YSI headquarters in Yellow Springs, OH on October 21, 2008 with follow-up interviews on October 28, 2008. Two members from management who were involved in the implementation effort, one from IT and the other from Customer Services, with a combined 32 years of experience at YSI participated in the primary interview. The author also interviewed an end-user who worked at YSI during the implementation and a manager from the Human Resources department to obtain overall impressions about the company's ERP education and training programs.

YSI uses the ERP system for approximately 70% of the processes and systems in the company. The current system replaced three legacy systems. It contains 32 modules including human resources, finance/accounting, inventory, purchasing, production,

engineering, shipping, repair and quality ERP modules. The touch labor workforce at YSI interacts daily with these ERP modules primarily through PC stations. Some examples of system use include transactional work such as receiving, managing inventory, repairables, order planning, scheduling, and shipping.

Analysis Methods

Because this study used a multiple case study methodology, the analysis occurred in two parts. First, the study analyzed each case study individually, created an individual case report and sent this report back to the interviewed participants to ensure its accuracy and approve its contents. Then, the researcher conducted a cross-case analysis to develop overall findings and to draw conclusions from the collected data (Yin, 1989).

As described in the research design portion of this chapter (under components 4 – *Logic linking data to propositions* and 5 – *Criteria for interpreting the findings*), these analyses used pattern matching to support either the theoretical propositions or a potential rival proposition. From these analyses, the study adjusted the theory to reflect the findings, then conducted comparisons of and developed recommendations for the proposed ECSS end user training plan. Finally, the researcher completed the analysis, results and conclusions portions of this thesis. Figure 5, adapted from Yin (1989), clearly shows the overall analysis steps and, in addition, provides an overview of the entire multiple case study research process.

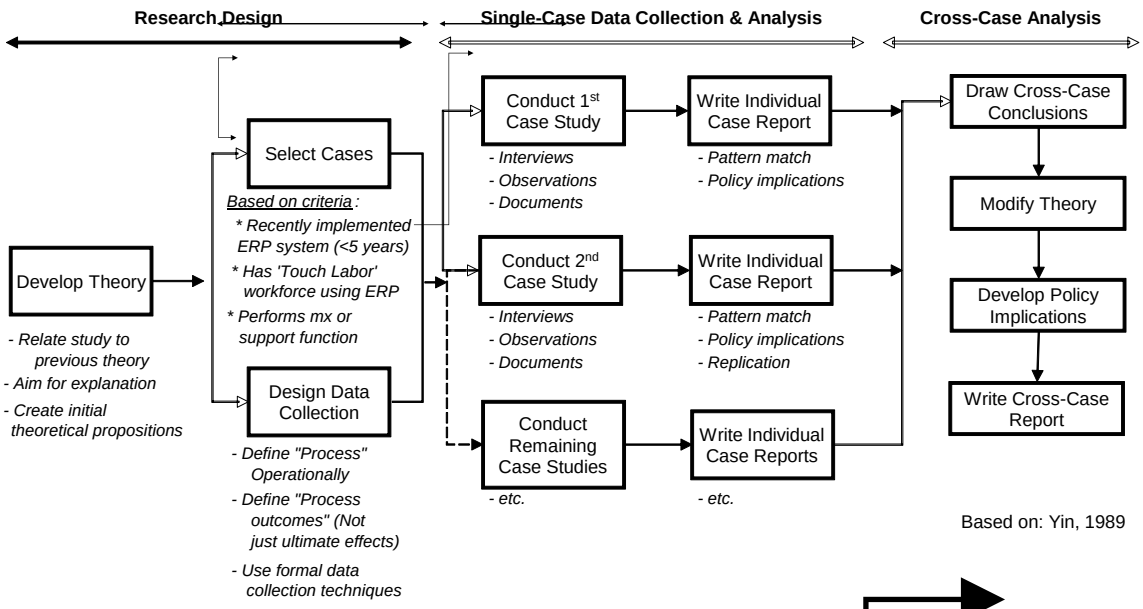


Figure 5. Multiple Case Study Implementation Methods

Proposition Testing Against Case Studies

The study answered the first IQ – *(What does the literature define as critical education and training factors needed for a successful ERP implementation?)* as part of the literature review synthesis. From this synthesis, the author found a total of eight education and training factors that seemed to influence the success of an ERP implementation. From these success factors, the author developed eight propositions about education and training programs. This section describes the methodology used to address $\mathbf{IQ_2}$ – (*How do these education and training factors compare to the methods used by industries for touch labor workers while implementing an ERP?)* by explaining the study's testing of these propositions against the five cases.

For the education propositions (propositions 1-3), the author tested the propositions in two ways. First, the author used open-ended interview guide questions (see Appendix C, questions 8-16) to determine the level of verbal support the respondents

had for each education proposition. These responses were pattern matched during cross-case analysis to build an overall picture of the cases' support for each education proposition.

After this, the interviewed respondents rated the influence meeting each of the people, process and technology-motivated ERP education needs have on the overall ERP implementation success. The study accomplished this with a 9-point Likert scale ranging from [-4] (very negative influence) to [0] (no influence) to [4] (very positive influence), using three questions for each education need. Table 6 provides an example of the Likert scale used during the examination of education factors. A complete copy of the Likert scale used for the education factors is found in the primary interview guide (Appendix C after question 16).

Table 6. Education Factor Likert Scale

		Influence on Overall ERP Implementation Success								
	Possible Education Factors	Very Negative Influence	↔ Between	Moderate Negative Influence	↔ Between	Not Influential	↔ Between	Moderate Positive Influence	↔ Between	Very Positive Influence
People Motivated Needs	1. Understanding How Jobs will Change	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
	2. Understanding Why Jobs will Change	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
	Questions 3-12 in same format, but address the Process motivated, technology motivated and timing of the education effort	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]

For the training propositions (propositions 4-8), a similar method was used. As with the education propositions, the author first used the open-ended interview guide questions (see Appendix C, questions 17-26) to determine the level of verbal support the respondents had for each training proposition. The author then used pattern matching

during cross-case analysis to build an overall picture of the cases' support for each training proposition.

The Likert scale used for the training propositions was also similar. However, although the author used a comparable 9-point Likert scale from [-4] (very negative influence) to [0] (no influence) to [4] (very positive influence), unlike the education questions, the training questions were not matched. Rather they addressed each of the training propositions as well as providing other, often contradicting, questions to give the respondents additional inputs and possibly help with the development of rival propositions. Table 7 provides an example of the Likert scale used to study the training factors. A complete copy of the Likert scale used for the training factors is found in the primary interview guide (Appendix C after question 26).

Table 7. Training Factor Likert Scale

		Influence on Overall ERP Implementation Success								
	Possible Training Factors	Very Negative Influence	↔ Between	Moderate Negative Influence	↔ Between	Not Influential	↔ Between	Moderate Positive Influence	↔ Between	Very Positive Influence
What:	1. Employees given job specific training	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
	2. Employees training limited to general ERP system use	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Questions 3 - 14 in same format, but address 'Who', 'How', 'When' and 'How Long'		[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]

In addition to the education and training proposition testing methods described above, for three of the five companies the author also interviewed a touch-labor worker. This helped the author determine how effective the overall education and training programs were on meeting the end user's needs. These findings rounded out the overall findings

for the individual cases and helped match education and training efforts to the satisfaction level of the end users.

The researcher also developed several generalized questions concerning the overall makeup of the company's education and training programs. These included such things as the timing and methods used by the company to educate or train the ERP system end users. The answers to these supplementary questions provide insights beyond the tested propositions. The researcher included the key insights from these supplementary questions as part of the additional findings of this study.

Reliability and Validity of the Overall Research Design

Reliability and validity refer to the quality of the overall research design and execution. "Reliability is the degree to which the finding is independent of accidental circumstances of the research, and validity is the degree to which the finding is interpreted in a correct way," (Patton, 2002). In general, reliability refers to a quality of repeatability in the study. In other words, a reliable study can be repeated several times and still have the same results (Yin, 1989).

Validity, on the other hand, involves several different qualities in the research design and execution. These include face, construct, internal and external validity (Patton, 2002; Ellram, 1996; Yin, 1989). Meeting each of these forms of validity is important to the overall validity of the research. The study now discusses these four qualities of validity in-depth:

1. **Face Validity.** Face validity revolves around whether the research seems reasonable and believable "on the face of it," (Patton, 2002). This form of

validity addresses whether the researcher developed theories and conclusions in a manner that appears correct to the reader. Simply put, face validity answers the question, "Does the research look right?"

2. **Construct Validity.** Construct validity covers both the validity of studying selected factors and the validity of the measurement of these factors (Yin, 1989). For example, this study chose eight theoretical propositions, based on the literature, to use as the constructs for the case study research. In this case, high construct validity involves two things. The first of these is whether the researcher actually studied the right things (chose the correct propositions). The second is whether the researcher measured these things in the right way.

3. **Internal Validity.** Internal validity in a case study involves the proper use of inferences about things the researcher cannot directly observe (Yin, 1989). For example, this study examines education and training used during ERP implementations, but never directly observes either an education or training program or an ERP implementation. In the absence of this direct observation, to have a high internal validity, a study must make the correct deductions about the data based solely on a holistic understanding of the information.

4. **External Validity.** External validity is a measure of how generalizable the study's findings are beyond the research (Yin, 1989; Ellram, 1996). Developing external validity often comes from replication and verification. This study will attempt to generalize from the literature and studied cases to the USAF's implementation of ECSS. Thus, the study must meet a high external validity through its multiple-case

replication and verification of perceived patterns in the data if the researcher desires this expansion of theory to broader applications. Table 8 provides further explanation of the reliability and validity factors used during the research and demonstrate this study's proof of compliance with these factors.

Table 8. Tests of the Overall Research Design

Tests	Case Study Tactic	Phase of Research in Which Tactic Occurs	Proof of Compliance in this Study
Reliability *Repeatability of the research (with the same results)*	Use case study protocol	Data Collection	Study used interview guide (Appendix A) with interview methods from Yin (1989), Patton (2002) and McCracken (1988) & a typical multiple-case study flow (Figure 4)
	Develop case study database	Data Collection	Study created case study database including completed interview guides, notes, completed case studies and any documentation provided by the individual case studies
Face Validity *Research results seem reasonable & believable*	Use direct quotations to support the findings	Data Analysis / Composition	Multiple validating quotations used throughout study
	Have key informants review draft case study reports	Composition	Study offered individual case reports to informants for review & comments & corrected any reported errors
	Have intended audience review draft cross case report	Composition	Study offered draft cross case report to intended audience for review & comments
Construct Validity *Proper operational measures used for the concepts being studied*	Use multiple sources of evidence	Data Collection	Literature review, Multiple case studies
	Establish chain of evidence	Data Collection	Study explained the links between the questions, the data and the conclusions
	Have key informants review draft case study reports	Composition	Study offered individual case reports to informants for review & comments
Internal Validity *A causal relationship exists - no spurious relationship could explain findings*	Do pattern matching	Data Analysis	Data coding and pattern matching used to justify either theoretical propositions or rival theories
	Do explanation building	Data Analysis	Data coding and direct quotations used to either explain theoretical propositions or rival theories
External Validity *Generalizability of the research*	Use replication logic in multiple-case studies	Research Design	Multiple case-study methodology used
	Verifying cross-case patterns match individual case studies	Data Analysis	Study examined individual case study patterns to attempt to verify their match with either propositions or rival theories

Developed from: Patton, 2002; Ellram, 1996; Yin, 1989; McCracken, 1988

Summary

This chapter addressed the methods used by the study to address the questions essential to the overall objectives of this research. The chapter started with a restatement of the research objective, to help create an ECSS education and training strategy for the USAF, before describing the grounded theory paradigm that frames the research. The chapter then explained the methodology as a three-step process of induction, deduction and verification. These phases switch from an exploratory (induction) to explanatory (deduction & verification) research focus, and from an analysis/synthesis (induction) to multiple case study (deduction & verification) research strategy. The chapter then discussed the two research designs used for this study, including an in-depth explanation of the five components required for a case study. Next, the chapter explained the sources and collection of data including the criteria for case selection and the interview techniques used during data collection. The chapter then explained the analysis methods used to create the findings and conclusions found in chapters IV and V. Finally, the chapter concluded by explaining the methods used to obtain reliability and validity of the overall research design.

Chapter IV. Analysis and Results

Overview

This chapter provides the aggregate data analysis and results from the five case studies. The researcher used these results to test the hypothetical propositions presented in Chapter II in order to answer IQ_2 – *How do these education and training factors compare to the methods used by industries for touch labor workers while implementing an ERP?* In addition, as part of this analysis, the research provides insights into the impact the studied cases' education and training programs had on the potential education- and training-related ERP implementation problems identified in Table 3 of this study. The chapter then provides additional findings in both quantitative and qualitative formats. Finally, the chapter concludes by providing a comparison of the proposed USAF ECSS end user training plan to the methods described in the literature and used by the studied cases. This final step answers IQ_3 – *Based on the results of IQ_1 & IQ_2; how well does the proposed USAF ECSS end user training plan compare to the literature and methods used in industry?*

Testing of Propositions

The researcher summed the Likert values developed for each of the education and training questions (across the five cases) to develop an idea of the overall support for each proposition. For the education propositions, which contained three parts each, the possible sums for individual parts ranged from [(-20) to 20]. The overall education propositions resulted from the sum of the three individual parts and thus ranged from [(-60) to 60]. The training propositions (except P_8, described later) each consisted of only one part, so their sums ranged from [(-20) to 20].

In general, the study took a conservative view on levels of support for the proposition's parts and the overall propositions. For the individual parts of a proposition, the study considered a summed value in the range of [> 14 to 20] to be full support and required full support for all parts of a proposition to declare it overall fully supported. The study deemed a summed value of [≥ 8 to ≤14] as partial support for an individual part of a proposition. The study classified any summed values between [> (-8) and < 8] as not supported. On the other side, summed values between [≤ (-8) and ≥ (-14)] were categorized as partially refuted and summed values between [< (-14) and (-20)] were considered fully refuted.

As one may imagine, the quantitative data captured using the Likert scales and then measured as described above was very important to this study's overall findings. However, the most important information collected were the long discussions with the interviewed managers around these numbers. Indeed, this discussion provided the most insight into the proposed relationships between each of the propositions and the potential education- and training-problems. Thus, the combination of quantitative data from the Likert scales and qualitative information from the interviewed managers helped the researcher discover not only what factors were important from an education and training standpoint but also why the factors were important and how they affected the overall implementation success.

Education Propositions

The education propositions revolve around the people-, process- and technology-motivated education needs of end users. Each proposition addresses how meeting one of these needs will reduce education-related problems during an ERP implementation.

Thus, the education propositions all contend that meeting the individual end user's people-, process- and technology-motivated education needs will have a positive influence on the overall ERP implementation's success by reducing the education-related ERP implementation problems.

Before the study continues with the individual education proposition testing, it seems prudent to explain one generalized finding about the education propositions. Although the Likert scale had a range of [(-4) – very negative influence] to [0 – no influence] to [4 – very positive influence], no education-related factor was rated below zero by any interviewed manager. As a result, the possible sums for individual parts of the propositions ranged from [0 to 20] and for the overall propositions from [0 to 60]. Thus, one general finding was that providing education about an ERP system was viewed as either positive or non-influential on overall ERP implementation success.

Proposition One – People-Motivated Education

► P_1: Address Employees' Readiness for Change (People-motivated Need):

ERP implementations will reduce education-related problems when a company provides education on what job changes will occur, why the job changes are necessary and how they benefit the employees

P_1 received partial support from the interviewed managers. This was reflective in all parts of the proposition receiving summed totals between 11 and 14 points, and the overall proposition's score of 37.5. Table 9 provides a summary of the proposition scoring results and the level of support this proposition received from the individual case studies.

Table 9. Proposition 1 – Level of Support

		Case Values [Range -4 to +4]						
	Proposition 1 - Address Employees' Readiness for Change	Appleton Papers	Avery Dennison	Cisco	NCR	YSI	**Sum**	**Level of Support**
People Motivated Needs	1.1. Understanding How Jobs will Change	3	3	2	0	3.5	**11.5**	Partially Supported
	1.2. Understanding Why Jobs will Change	3	2.5	4	0	3	**12.5**	Partially Supported
	1.3. Understanding How Changes Benefit Employees	3	2	4	2	2.5	**13.5**	Partially Supported
						Overall Proposition	**37.5**	**Partially Supported**

As seen in Table 9, the interviewed managers generally supported addressing employees' readiness for change as positive, with a quite a few responses indicating that the managers felt that this type of education had between a moderate and very influential effect on overall ERP implementation success. For example, the interviewed managers at Appleton felt that educating employees about how the new ERP system will affect them was vital to developing user acceptance. As one Appleton manager put it, "I think the education portion showed them how the new system would benefit them and users were pretty accepting of the system by the time we went live."

The anomaly in Table 9 was the response from NCR Corp. NCR had already streamlined business processes and completed most of the changes that many companies face during an ERP implementation prior the implementation explored during this study. The company was also already using an Oracle 10.7 system, a direct predecessor of the Oracle 11i system they installed. In addition, three of the four core implementation members were from the Morristown plant studied during this research.

For these reasons, the interviewed managers at NCR felt the impact of the people-motivated education on overall implementation success was minimal (as well as the process- and technology-motivated education factors in P_2 and P_3) in most areas. As one NCR manager explained, despite the short education effort, "the people (in the plant) at the time probably felt pretty comfortable and had been engaged to some degree." The interviewed end user from NCR supported this idea. He recalled feeling that the new ERP system would have a big affect on his job, but that he was "pretty well informed for what was coming."

Proposition Two – Process-Motivated Education

► **P_2: Address Process Changes (Process-Motivated Need):**

ERP implementations will reduce education-related problems when a company educates employees on the new business processes, including what changes will happen, why the changes are necessary and how the employees' work fits into the overall process

P_2 also received partial support from the interviewed managers; however, this proposition did receive the most support of any education proposition. Two parts (2.1 – Understanding Changes to Business Processes and 2.2 – Understanding Why Business Changes are Necessary) met the criteria for full support with summed values of 15.5 and 14.5 respectively. However, the third portion of this proposition, (2.3 – Understanding how End User's Job Fits into the Overall Business Processes) was only partially supported with a summed value of 11. This resulted in the study's categorization of this proposition's overall level of support (total summed value of 41) as partial. Table 10 provides a summary of the proposition scoring results and the level of support this proposition received from the case studies.

Table 10. Proposition 2 - Level of Support

		Case Values [Range -4 to +4]						
	Proposition 2 - Address Process Changes	Appleton Papers	Avery Dennison	Cisco	NCR	YSI	**Sum**	**Level of Support**
Process Motivated Needs	2.1. Understanding Changes to Business Processes	4	4	3	1	3.5	**15.5**	Fully Supported
	2.2. Understanding Why Business Changes are Necessary	4	2.5	3	2	3	**14.5**	Fully Supported
	2.3. Understanding how End User's Job Fits into the Overall Business Processes	1	3	3	0	4	**11**	Partially Supported
						Overall Proposition	**41**	**Partially Supported**

The interviewed managers considered addressing the process-motivated education needs of employees very important. Every company (except NCR for the reasons previously discussed) gave at least two parts of this proposition positive rankings of three to four for their overall influence on ERP success. Some companies organized their end user education around the business process changes and highly supported this education proposition. For example, Cisco uses an Organizational Adoption program as part of their ERP implementations. Cisco integrated this program into the overall ERP implementation and provided end user education with a goal of "identifying business impacts to drive user communications."

The two highest individual total scores for this proposition came from YSI (10.5) and Avery Dennison (9.5). These companies were, in addition to adding an ERP system, modifying their businesses from a silo-based structure to a more process-based structure. Thus, for these companies the changes to business processes brought about by the ERP system were dramatic. The interviewed managers at both companies felt the education program must address these changes. The interviewed manager at Avery explained this

feeling with, “The biggest thing with an integrated package type suite like ERP is understanding that you are not in a silo and in my experience, even with education, you still are going to have a lot of that.” He continued, explaining that the goal of process-motivated education is “to try to ‘culturalize’ employees to help them understand how the far reaching impacts of a tightly integrated system will affect business processes.”

Proposition Three – Technology Motivated Education

► **P_3: Prepare Employees for Glitches (Technology-Motivated Need):**

ERP implementations will reduce education-related problems when a company educates employees on potential problems with the ERP implementation, including why problems happen, how to identify the problems and what the employees can do to get them fixed

Similar to outcomes of the other two education propositions, P_3 received partial support from the interviewed managers. This proposition was the least supported education proposition with one part (3.1 – Making End User Aware of Potential for Glitches) categorized at not supported with a summed value of only 6.5. The remaining two parts (3.2 – Explaining How Users could Identify Glitches and 3.3 – Explaining How Users could Report Glitches) were categorized as partially supported with values of 12.5 and 10.5 respectively. Overall, this proposition had a total summed score of only 29.5, a full 8 points behind the next lowest education proposition. Table 11 provides a summary of the proposition scoring results and the level of support this proposition received from the case studies.

Table 11. Proposition 3 – Level of Support

		Case Values [Range -4 to +4]						
	Proposition 3 - Prepare Employees' for Glitches	Appleton Papers	Avery Dennison	Cisco	NCR	YSI	**Sum**	**Level of Support**
Technology Motivated Needs	3.1. Making End User Aware of Potential for Glitches	2	1	0	0	3.5	**6.5**	Not Supported
	3.2. Explaining How Users could Identify Glitches	2	3	4	0	3.5	**12.5**	Partially Supported
	3.3. Explaining How Users could Report Glitches	3	3	1	0	3.5	**10.5**	Partially Supported
						Overall Proposition	**29.5**	**Partially Supported**

As seen in Table 11, this education proposition received many low scores (although no negative ones). However, the interviewed managers provided varying levels of verbal support for this proposition. For example, when asked about educating employees on the potential for problems, both managers at NCR felt that this should not occur as part of the education effort. As one manager put it, "In the education, you really don't want to go in and say, 'you're going to have problems'. Everybody thinks computers shouldn't make errors and shouldn't have problems." To clarify this position, the manager added, "During the education you want to be positive and you just want to maybe emphasize that there's going to be enough up-front work that surprises will be minimized."

On the other hand, the managers at YSI felt that discussing the potential problems in their education program would have been beneficial because it would have developed more realistic user expectations. In the words of one YSI manager, "everybody was ready for the system, but they weren't prepared for things that could go wrong." This had a dramatic effect on the initial acceptance of YSI's ERP system when problems surfaced during 'go-live'.

Both of the interviewed managers at Appleton supported the YSI viewpoint that companies should discuss potential problems during the education program. One manager at Appleton pointed out that in areas where the new ERP system had more problems during implementation, human nature and reluctance to change made acceptance tougher. However, the manager also explained that the education program had prepared users for the potential for these problems and stated, "I don't think anyone was surprised or disillusioned to think that they weren't going to run into any issues."

The interviewed end user at Avery also strongly supported the idea that a company should explain the potential problems of an ERP implementation during the end user education program. As she clarified, "I want to know about the potential problems because they're going to happen. If you wait until all the bugs are gone, you would probably never be at a time you could 'go-live'." She continued this thought with, "As long as you know the things that could go wrong as you go through the system and that people are trained and consultants are there, if you have a problem then you know it's going to be fixed."

Links between Education Propositions and Education-Related Problems.

The education proposition testing section ends with an explanation of how the education program around these propositions links to the ERP implementation education-related problems (previously identified in Table 3). The study did not capture quantitative data on the impact the education program has on each of the identified education-related problems. However, a significant amount of commentary from both the interviewed managers and end users did help establish these links and the researcher

believes these links are valid in varying levels for the five case studies. Figure 6 shows the identified links between the overall education program and potential education-related problems of ERP implementations.

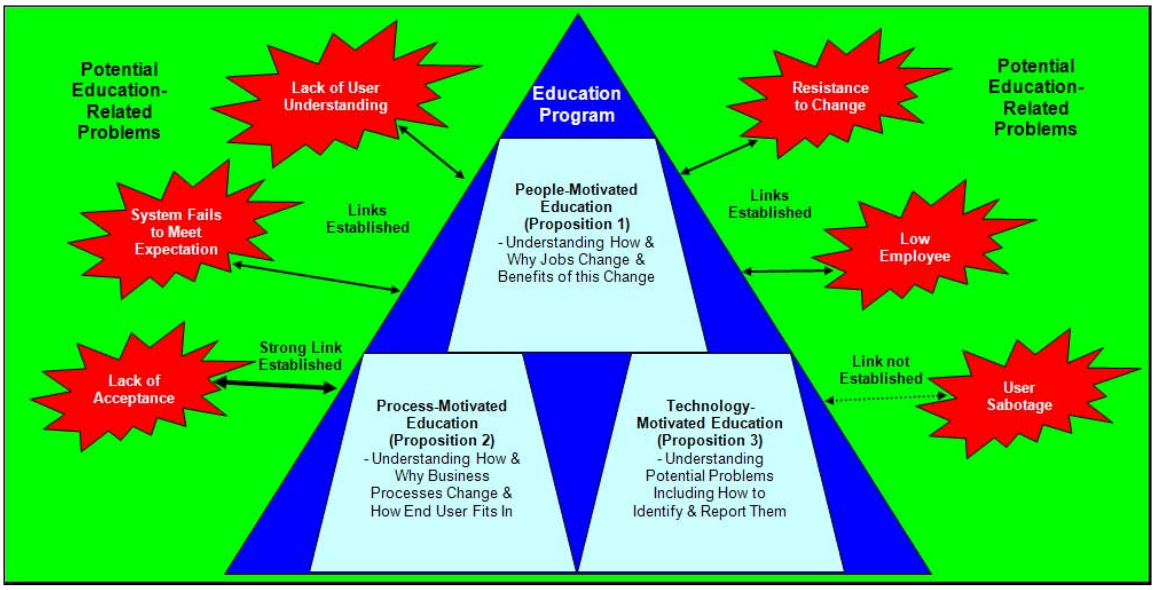


Figure 6. Education Program Links to Education-Related Problems

As seen in Figure 6, the interviewed managers and end users indicated many links between the company's education program and potential education-related ERP implementation problems. These links were either established by the respondent explaining how the education program helped overcome the problem (good link), or how a failure in the education program led to the problem occurring (bad link). A company's ERP education program may have both good and bad links to these problems. For example, YSI's education program affected the ERP implementation by helping to build end user acceptance and overcoming user resistance to change prior to 'go-live' (good link) and by failing to meet user expectations due to a lack of communication about potential problems (bad link).

By far the strongest link between the education program and education-related problems was with user acceptance and buy-in. Every case studied mentioned this link and the varying levels of acceptance that the company's education program helped develop prior to 'go-live'. Some respondents felt that building user acceptance and buy-in prior to 'go-live' was paramount to implementation success. One clear example of this came from Cisco, where the interviewed managers explained that the company's ERP education strategy attempts to build not only buy-in, but also ownership prior to 'go-live'.

Although the interviewed managers and end users established links between the company's education effort and most of the potential education-related problems, the researcher could not confirm the link between education and user sabotage. The researcher partially expected this finding since all studied cases were of successful ERP implementations. One surmises that this link is only valid in extreme cases of ERP education failure, but this is only conjecture and user sabotage may have other causes not explored by this study.

The study also did not establish internal links or relationships between each of the education-related problems but there also appears to be some connection between the potential problems. For example, Lack of User Acceptance and Buy-In (for the system), Lack of User Understanding (of the system) and Resistance to Change (to the system) all appear interconnected. The author believes that a true understanding of these relationships would provide interesting insights for any researcher pursuing the connection between ERP implementation problems and ERP education programs.

Training Propositions

The training propositions revolve around what to train, who should train, how to support training, when to train and how long to train. Each proposition addresses how meeting one of these facets will reduce training-related problems during an ERP implementation. Thus, the training propositions all contend that meeting the individual end users' training needs will have a positive influence on the overall ERP implementation's success by reducing the training-related ERP implementation problems.

With the exception of P_6 (How to Support Training) the author asked the interviewed managers at least two questions for each proposition. The first question related to the study's primary propositions while the second provided a counter or rival proposition. These secondary questions were, as closely as possible, developed to directly oppose or contradict the study's primary propositions to help identify if rival propositions also (or better) explained the required training of end users.

Proposition Four – What to Train

► P_4: Training Tailored to Employee's Job (What to Train):

ERP implementations will reduce training-related problems when a company applies a training program that is not generic and focuses on that employee's actual job

P_4 received full support from the interviewed managers. Indeed, this was the only proposition to have a 'perfect' score of 20, indicating that all interviewed managers felt providing specific training would have a very positive influence on overall implementation success. The rival proposition developed for P_4: *employee training was limited to general ERP system use* was not supported by the interviewed managers and had an

overall summed score of (-4). Table 12 provides a summary of the P_4 primary and rival scoring results and the level of support these propositions received from the case studies.

Table 12. Proposition 4 – Level of Support

	Case Values [Range -4 to +4]						
Proposition 4 - Training Tailored to Employee's Job	Appleton Papers	Avery Dennison	Cisco	NCR	YSI	**Sum**	**Level of Support**
Proposition: Employees given job specific training	4	4	4	4	4	**20**	Fully Supported
Rival Proposition: Employees training limited to general ERP system use	-2	1	2	-4	-1	**-4**	Not Supported

As Table 12 clearly shows, the interviewed managers strongly felt that job specific training is necessary for a successful ERP implementation's training program. Every interviewed manager fully supported this concept. The following key excerpts from the interviews expand upon the proposition four findings from Table 12:

> **Cisco -** Training using a copy of the ERP system and covering "real scenarios of operational systems" that the employees "need to do their job" is essential.
>
> **NCR -** "If you only give them general training, like vendor-training, it won't be good – not for the implementation or for the employee. It has to be specific."
>
> **YSI -** Creating "a day in the life of the business" training is crucial.

The interviewed managers did not support the rival proposition that training should be limited to general ERP system use. Indeed, the prior comment from NCR clearly expressed both support for specific training and lack of support for generalized training. However, while specific training was definitely the preferred method, the managers at both Avery and Cisco did express that providing some generalized training

was better than the alternative of providing no training at all. This belief was reflective in their positive scoring for the rival proposition.

Proposition Five – Who Should Train

► P_5: Train the Trainer Program Used (Who Should Train):

ERP implementations will reduce training-related problems when a company fully trains some qualified, willing and able employees to train the remaining workforce

P_5 also achieved full support from the interviewed managers and received a summed score of 17. The rival proposition the study developed for P_5 was *ERP vendors provide employee training*. The interviewed managers did not support this rival proposition and gave it an overall summed score of (-4). Table 13 provides a summary of the P_5 primary and rival scoring results and the level of support these propositions received from the case studies.

Table 13. Proposition 5 – Level of Support

	Case Values [Range -4 to +4]						
Proposition 5 - Train-the-Trainer Program Used	Appleton Papers	Avery Dennison	Cisco	NCR	YSI	**Sum**	**Level of Support**
Proposition: In house (employee) trainers used to train employees	3	4	3	4	3	**17**	Fully Supported
Rival Proposition: Employees given ERP vendor provided training	-1	-3	3	-4	1	**-4**	Not Supported

Every one of the studied cases strongly supported the use of a subject matter expert (SME) train-the-trainer program (*Note: This study interchangeably uses the terms SME and Super User*). The interviewed managers provided many reasons to use this training philosophy. First was the cost of the train-the-trainer program versus

professional training. The manager at Avery explained this idea with, "The train-the-trainer concept has got to be huge for you (the USAF) as well. I think it's effective, but it's also inexpensive in comparison to getting everyone trained professionally."

Appleton used the train-the-trainer philosophy for three core reasons. First, Appleton SMEs acting as train-the-trainers for their area could both provide relevant training (rather than generic) and speak in terms their peers could understand. In addition, as Appleton SMEs they were uniquely able to set up useful training manuals (with training group guidance for standardization). These manuals acted as end user references and guides during classroom training, post-training while testing the developmental system and during the actual 'go-live'. Finally, by having in-house SME trainers who were also touch labor workers, Appleton helped ensure they had expertise on the floor both during 'go-live' and beyond. The interviewed managers believed that coupling instructor led classroom training (ILT) with SMEs using the train-the-trainer method made the training very successful. Indeed, these managers specifically cited the train-the-trainer method of teaching as the way to go because, "you get ownership that way, and you automatically have your experts within your company."

The managers at NCR also felt the train-the-trainer program was a vital part of an ERP implementation, both during training and after, and rated this factor as very influential to the overall implementation success. Beyond just the pre-'go-live' training effort, the team of NCR trainers, from corporate down to super users were valued as enablers for success during the ERP system 'go-live'. As one NCR manager explained, "At Systemedia (NCR division), we tried to have track leads and super users at each plant so if the workers at the touch level had issues, they could go to that local super user."

He added that, based on NCR's ERP governance structure, SME trainers enabled implementation problem resolution to happen at the lowest possible level. Describing how implementation problems flowed up from the end users to the in-house SMEs to the in-house track leads and then to the corporate implementation team, he concluded, "That was the hierarchy of how you address problems, so you have to have the in-house train-the-trainer and super users to make that happen."

The managers interviewed at Cisco considered using SMEs with a train-the-trainer philosophy as very valuable towards getting job specific training with fewer problems. As one manager explained, "SMEs work as train-the-trainers. The training and documents they make are only as good as the known problems, and there may be some problems in the training process, but using SMEs helps catch a lot of them." In addition, the Cisco managers noted that using in-house SMEs helps develop end user buy-in for and acceptance of the training. As one Cisco manager put it, "The SME creates the training and says 'this works', 'this is how it works', and they sign off that they agree with it. This helps build support for the training."

The end users at Avery, NCR and YSI all felt that in-house SME trainers were the most effective at providing the training and help they needed. For example, the end user at Avery felt these trainers were most effective because, "They put together the training and really understood the job we did and were able to take what we did today, understand how we will do it tomorrow and train the users." For the worker at YSI, the in-house trainer was the most effective because the person was on the floor during 'go-live' and able to help with some of the problems.

Unlike the train-the-trainer program, there was very little support for the rival proposition that ERP vendors should provide training. Only two companies, Cisco and YSI gave positive values to this proposition. The scores of these companies for this proposition are probably indicative of the relationships the companies had with their ERP vendors. For example, Cisco works very closely with its ERP vendors and has a collaborative implementation relationship, including training development and delivery. However, this experience with vendor-provided training was not universal and interviewed managers from other companies provided comments such as "generic", "terrible" and "worthless" when referring to vendor training.

Proposition Six – How to Support Training

► **P_6: Training Manuals Used (How to Support Training):**

ERP implementations will reduce training-related problems when a company develops job specific training manuals to support employee use of the ERP system

Like the previous two training propositions, P_6 also received full support from the interviewed managers and had a summed score of 16. Unfortunately, it was not until late in the data collection period that the author discovered that no rival proposition for P_6 was offered to the interviewed managers. Therefore, the study was unable to develop an understanding of the impact the potential rival proposition (not using training manuals to support ERP implementation) would have on overall implementation success. Table 14 provides a summary of the proposition scoring results and the level of support this proposition received from the individual case studies.

Table 14. Proposition 6 – Level of Support

	Case Values [Range -4 to +4]						
Proposition 6 - Training Manuals Used	Appleton Papers	Avery Dennison	Cisco	NCR	YSI	**Sum**	**Level of Support**
Proposition: Employee training supported by job specific user manuals	3	3	3	4	3	**16**	Fully Supported

All of the studied cases provided users with training manuals, some in both paper and online formats. There was a consensus that the company should tailor these manuals to each employee's job or position to reduce the size and maximize the effectiveness of these manuals. In addition, for large companies with workers doing the same job but at different locations with varying practices (similar to the USAF), the managers supported the idea of locally tailoring these manuals to overcome these differences. The managers at NCR explained this concept stating, "One of the advantages of personalizing (training materials) at our level rather than the corporate vanilla package was because we do things a little different than how things are done throughout the company."

As touched upon during the train-the-trainer proposition discussion, one advantage of using SME trainers is the ability to create or improve the training materials and manuals. Indeed, all the studied cases used their SME trainers to either create or tailor the training and to make detailed, job- or role-specific training manuals. One example of this concept comes from Cisco. Cisco provides detailed, job specific manuals created by SMEs to help support all stages of training and as a reference after 'go-live'. As one Cisco manager explained, "We really want to make sure that somebody who

knows the subject is the one who makes the documents and provides what the end users want to know in the language that they use."

Although Cisco uses in-house SMEs to create these manuals, they couple these SMEs with outside companies who specialize in training development. This collaboration, as one Cisco manager explained, is because training development is not a core company competency. To overcome this lack, Cisco leverages in-house knowledge with external 'know how'. As the manager explained, "That's where the expertise comes from the collaboration with outside companies who have the knowledge on how to build the training and change management materials and the SMEs from within the business units."

Proposition Seven – When to Train

► **P_7: Timely Training (When to Train):**

ERP implementations will reduce training-related problems when a company completes training just before an implementation's 'go-live'

P_7 received partial support from the interviewed managers and attained a summed score of 13. The rival proposition the study developed for P_7 was *employees are trained to use the system after 'go-live' date*. The interviewed managers fully refuted this rival proposition, giving it an overall summed score of (-17). Table 15 provides a summary of the P_7 primary and rival scoring results and the level of support these propositions received from the case studies.

Table 15. Proposition 7 – Level of Support

Proposition 7 - Timely Training	Case Values [Range -4 to +4] Appleton Papers	Avery Dennison	Cisco	NCR	YSI	Sum	Level of Support
Proposition: Training conducted just prior to 'go-live' date	4	3	-2	4	4	**13**	Partially Supported
Rival Proposition: Employees trained to use system after 'go-live' date	-3	-3	-4	-4	-3	**-17**	Fully Refuted

Although the rival proposition was fully refuted by the interviewed managers, P_7 appeared well on the way to full support with four of five of the studied cases giving this proposition a score of three or four. Most of the interviewed managers gave examples of how timing the training close to 'go-live' helps with training retention and increases user proficiency. Using this just-in-time strategy has other benefits besides recency and increased user proficiency. As the managers at YSI explained, "The closer to 'go-live' the better because the ERP system is more set."

The 'closeness' of the training was variable depending on how much training each company conducted and some limitations, such as the number of trainers and training facilities. These limitations were evident in a few of the studied cases. To insure training is as close to 'go-live' as possible, one Appleton manager suggested, "you take the amount of training you have to get done, the number of people and the facilities you need to get the training done, and you calculate back as close as possible to 'go-live.'"

Some interviewed managers did point out problems with the just-in-time philosophy for end training. For example, although the interviewed managers at NCR fully supported training just prior to 'go-live' with, "You train as close as possible to 'go-live' to keep it fresh in their minds," this support was conditional. They added the caveat that the timing

depends on the significance of the changes brought about by the ERP system. They explained that since the changes during NCR's ERP implementation were not very significant, allowing one month for training was good. One manager added that, "If you're in an environment where you've got big changes, you probably want to do it prior to a month and maybe have multiple steps. So it depends on how much change there is."

In addition to the significance of the changes brought about by the ERP system, a company's overall training strategy also influences when to conduct training. Indeed, this was the reason the interviewed managers at Cisco indicated that conducting training just prior to 'go-live' or worse, after 'go-live', were both negative influences on the overall ERP implementation effort. They explained that although the time between initial training and 'go-live' for a typical ERP implementation at Cisco was around 2 ½ months, they felt the training was not too early due to the progressive training methodology used. Further explaining this concept, one Cisco manager provided,

> There are a lot of activities that keep happening (during the training process). People are getting training but also measuring the experience and providing feedback and we're modifying the training based on the feedback, so there's a lot of things going on. The engagement will grow, but the training will be ongoing and the knowledge that people have will grow too. If you try to do this all right before you 'go-live', you won't be able to change things and people won't have time to grow the knowledge they need for 'go-live'.

Proposition Eight – How Long to Train

► P_8: Follow-up Training Provided (How Long to Train):

ERP implementations will reduce training-related problems when a company provides follow-up/continuous training to address changes from the initial training

P_8 consisted of two parts. $P_{8.1}$ (Training program changed as ERP system changes) received partial support from the interviewed managers with a combined score of 13. $P_{8.2}$ (Employee training is a continuous effort) had full support from the interviewed managers with a summed score of 16. Overall, this proposition was partially supported by the interviewed managers and had a total score of 29 out of 40.

The rival proposition the study developed for P_8 was *Employee training is a one-time effort with a definite end*. This rival proposition counters both parts of P_8 because if training occurs only once the fact that it can neither change nor be continuous is a tautology. The interviewed managers partially refuted this rival proposition, giving it a summed value of (-9). Table 16 provides a summary of P_8's primary and rival scoring results and the level of support these propositions received from the case studies.

Table 16. Proposition 8 – Level of Support

	Case Values [Range -4 to +4]						
Proposition 8 - Follow-up Training Provided	Appleton Papers	Avery Dennison	Cisco	NCR	YSI	**Sum**	**Level of Support**
Proposition 8.1: Training program changed as ERP system changes	0	3	4	3	3	**13**	Partially Supported
Proposition 8.2: Employee training is a continuous effort	3	3	3	3	4	**16**	Fully Supported
P_8 Overall Level of Support						**29**	Partially Supported
Rival Proposition: Employee training is a one-time effort with a definite end	-2	-3	0	-3	-1	**-9**	Partially Refuted

For the first part of P_8, Appleton, whose ERP system did not change after their training program, was the sole low score and rated this part as not influential on overall implementation success. One surmises that this score may have been different had

Appleton made major changes to its system after training, but this idea was not poised to the Appleton managers so is strictly theoretical. The remaining interviewed mangers all rated this as very positively influential on overall implementation success with scores of either three or four.

To explain why changing the training helps improve the overall training product, one Cisco manager provided that, "We adjust our training as things with the system change or as questions come up during instructor led training (ILT). Our (technical services) team comes in and shares, 'these are the types of questions we're getting' and we modify the training to fit that." The manager further explained that this modification helps reduce the number of questions not covered during ILT and enhances overall end user proficiency.

In addition to the instant feedback provided from ILT sources, Cisco also data mines from their ERP support database to determine the need for training changes. As one manager explained, "We also go into the database on support requests and we see what type of requests we get. Is it on holds, on revenues, on customer credits and we see what type of problems we need to focus on and we modify the training to meet these problems."

The interviewed managers all supported the second part of P_8, that training is a continuous effort, with a score of either three or four. Perhaps the best reasoning behind a continuous program came from YSI managers who explained that an ongoing and adaptive training program helps develop ERP expertise in super users and process leads. They added that this ongoing process also helps increase the overall capabilities of the ERP system.

On the other hand, almost all interviewed managers saw the rival proposition of a one-time training program as a negative influence on ERP implementation success. The one non-negative response, Cisco, rated this rival as non-influential on overall implementation success. This response was somewhat counter-intuitive given Cisco's support for an adaptive and ongoing training program. As Cisco uses a centralized repository for knowledge retrieval (including any online training and references, company approved workarounds and system change information), perhaps the interviewed manager felt these resources would overcome the one-time training effort and thus rated this effort as non-influential. Unfortunately, time constraints negated the ability to conduct follow-up questions on this subject and thus the researcher reports these initial findings and leaves these gaps in understanding as a path for further study of this idea.

Links between Training Propositions and Training-Related Problems.

The training proposition testing section ends with an explanation of how the training program around these propositions links to the ERP implementation training-related problems (previously identified in Table 3). As with the education-related links, the study did not capture quantitative data on the impact the training program has on each of the identified training-related problems. However, even more than for the education program, a significant amount of commentary from both the interviewed managers and end users did help establish these links qualitatively.

Indeed, based on the large number of observations and explanations provided in the interviewed managers and end users' comments, some direct links between the factor

underlying each training proposition and the various training-related problems did emerge. In addition, internal links between a company's train-the-trainer program and both job specific training and training manuals were evident based on the interviewed managers' explanations. As with the education-related links, the researcher believes these links are valid in varying levels for the five case studies. Figure 7 shows the identified links between the training program and potential training-related problems.

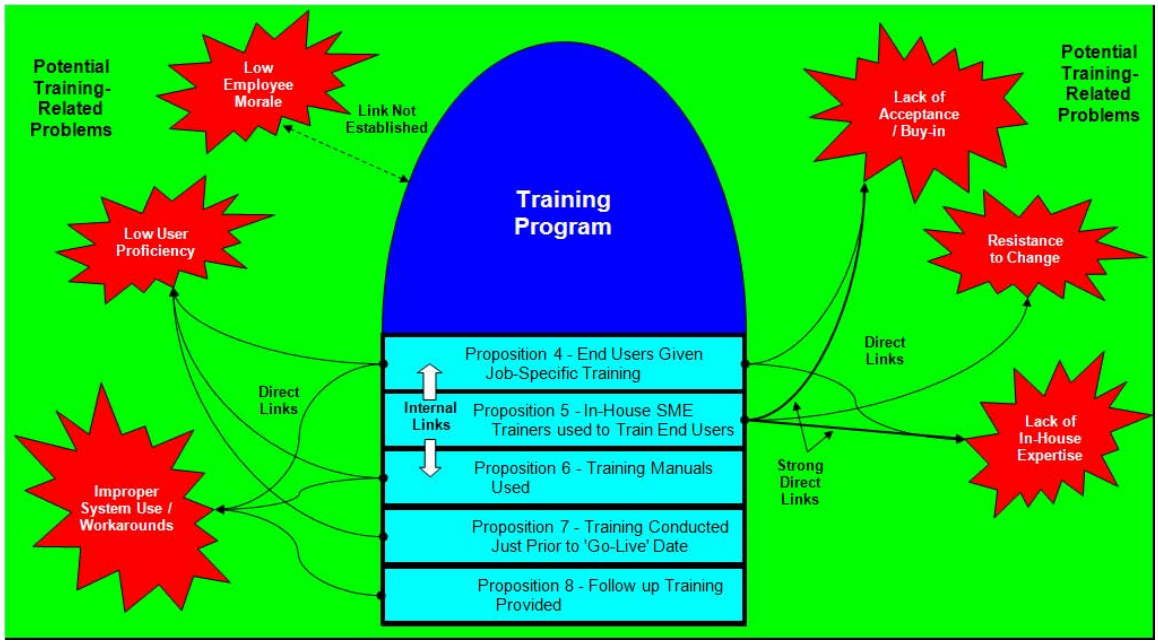


Figure 7. Training Program Links to Training-Related Problems

As seen in Figure 7, the interviewed managers and end users indicated many direct links between the factors underlying the explored training propositions and the potential training-related ERP implementation problems. Similar to the education-related problem links, these links were established by the respondent explaining how each training factor helped overcome the problem (good direct link) or how a failure executing the training factor led to the problem occurring (bad direct link). In addition, the

respondents helped establish strong internal links between the train-the-trainer program and both job specific training and training manuals.

The two strongest direct links to training-related problems both connected to the SME train-the-trainer proposition. The first of these links connects the train-the-trainer program to the lack of acceptance and buy-in implementation problem. During proposition testing, it was clear that both the interviewed managers and end users supported this connection. The study previously provided quotations from Appleton, Avery, Cisco and YSI during proposition testing in this chapter that demonstrated this link.

The second of these strong direct links was the connection between the train the trainer program and the lack of in-house expertise problem. During proposition testing earlier in this chapter, quotations from YSI, NCR and Appleton clearly displayed this direct link. In addition to the comments already provided in this study, one final support for this link came from Cisco. Explaining why they use in-house SMEs to train, an interviewed manager from Cisco provided, "In every phase and every responsibility, we always have a core in-house team member because the learning needs to stay in-house. We have learned over the past years that keeping the in-house experience is very important."

In addition to the strong direct links from the train-the-trainer program to the training-related implementation problems, the studied cases also revealed internal links between the use of the use of an SME train-the-trainer program and the effectiveness of the training manuals and job specific training. This study provided several examples of these internal links during proposition testing. The interviewed end user from Avery best summed up this connection. Responding to why she felt in-house SME trainers were the most effective, she explained, "The people training the end users actually did the jobs,

wrote the manuals and knew the system very well and so if you had a problem you could just ask a trainer."

One interesting observation was the lack of an established link between the low employee morale problem and a company's ERP training program. Respondents indicated that resistance to change, workarounds, low user proficiency and the remaining training-related problems all had direct links to the training program. However, the only mention of the low morale problem came during the discussion of education-related problems and the interviewed managers provided no connection between this problem and training. Perhaps this is indicative of successful training programs rather than the lack of a link, but further study is required to understand this connection.

Additional Findings

It became increasingly obvious during the analysis and results phase of this research that several unanticipated findings did occur. For some of these, specifically the 'methods to conduct training', the interview protocol captured not only qualitative, but also quantitative information and thus enabled a proposition-like testing of the factors. However, the study also captured other information, such as the training environment, overall training strategy, post-implementation normalization, etc. during the interview process, but failed to measure these quantitatively for importance. The study now presents these additional findings, starting with the additional quantitative findings.

Additional Quantitative Findings

The only additional quantitative findings found during the course of this study were the levels of support for various methods to conduct training. During the

interviews, the study explored four different methods to conduct employee training. Method 1 was *asynchronous computer-based training (CBT)*. This method received varying levels of support individually, but overall was not supported by the interviewed managers and summed to only one. Training Method 2 was *face-to-face classroom-style training*. This was the only training method that the interviewed managers fully supported, receiving an overall score 18 from the interviewed managers. Method 3 was *paper-based training*. This method was not supported and had a summed total of (-1). The final explored training method, Method 4, was *on-the-job training*. This method received partial support from the interviewed managers and summed to 13. Table 17 provides the four training methods explored by this study, along with their individual and summed levels of support.

Table 17. Methods to Conduct Training

	Case Values [Range -4 to +4]						
Methods to Conduct Training	Appleton Papers	Avery Dennison	Cisco	NCR	YSI	**Sum**	**Level of Support**
1. Employees given asynchronous computer-based training	3	-2	2	-4	2	**1**	Not Supported
2. Employees given face-to-face classroom-style training	4	4	3	4	3	**18**	Fully Supported
3. Employees given paper-based training	0	-3	2	0	0	**-1**	Not Supported
4. Employees given on-the-job training	2	2	2	3	4	**13**	Partially Supported

Asynchronous CBT vs. Instructor-led Classroom Training.

Among the methods to conduct training the first two methods, asynchronous CBT and instructor-led classroom training (ILT) generated a significant amount of specific discussion. Every one of the studied cases used ILT as primary training for their core

business processes. The importance of this primary training method reflected in all companies indicating this method had a greater than moderate to very positive influence on overall implementation success.

On the other hand, only two of the companies used asynchronous CBT and then only in a support role to provide generalized training. Neither the detractors nor supporters of asynchronous CBT felt that this training could stand on its own. Examples of the many insights provided by the interviewed managers concerning the impact of use of both asynchronous CBT and ILT follow, starting with NCR and Avery.

Neither NCR nor Avery used asynchronous CBT to support training and interviewed managers from both companies felt this training alone would not be sufficient to meet the end users' training needs. The interviewed managers provided clear viewpoints on this idea. At NCR, one manager explained, "When I think of computer-based training it's just someone who sits at a computer and gets trained rather than listen to someone and having someone teach, so it's not so much specific about using the equipment, it's a tutorial." He strongly added that, "We didn't use this, and I don't think this would have helped."

The interviewed manager at Avery provided a similar viewpoint with, "I'm not trying to discount web-based or CD-ROM-based tools and things like that, but only if they're used in conjunction with true face-to-face, instructor-led training. I don't think you can substitute for that." Explaining this thought, the manager provided that, "My opinion is web-based-only training is the wrong way to go. Instructor-led training is the only way to effectively get this type of training done – that's the biggest advice I can give you."

Both Appleton and Cisco leveraged asynchronous CBT and ILT as part of their overall training programs. Indeed, Cisco designs end-user ERP training programs using a progressive, blended learning model starting with basic material delivered via CBT and then advancing into modularized, job specific ILT (primarily from in-house SME employees) and finishing with practice sessions. However, as one manager put it, "I think that for the end user who's using the system every day, interactive training in the classroom is needed." Explaining the role of CBT in ERP training, the manager stated, "You have to have that initially and then probably additionally, you have web-based training available to allow them something to refer back to when they are on the job." However, the Cisco managers did not support CBT-only training and stated, "We have seen at Cisco that people have to have the interactive training to be effective."

Similar to the Cisco's respondents, the managers at Appleton also felt that asynchronous CBT should be only a part of an overall training program and agreed with the idea that this training should not be primary. As pointed out by the Appleton managers, "an ERP system is too complicated and its proper use is too vital to rely on online training alone." Appleton used ILT as primary training because this method provides the ability to get employees away from job distractions and dedicate them to the training process.

In addition to these benefits, the interviewed managers at Appleton also included that ILT provides an instantaneous two-way feedback method to help determine if employees understand the training. For these reasons, and because they felt CBT-only training would not meet their implementation needs, the Appleton managers considered ILT the most effective ERP training method. Summing up this viewpoint, one manager

provided the insight that, “Otherwise you have to depend on them doing it on their own time and having a reliable method of determining whether the training worked or not because with computer training it’s easy to click through it.”

Paper-based Training.

Of the methods to conduct training, paper-based training received the least support. This method involves using textbooks or training manuals and paper-based exercises / testing rather than computer-based training, either in the classroom or via distance learning. Several companies felt that paper-based training only provides ERP system theory rather than experience using the ERP system. Indeed, the interviewed managers at Avery, NCR and YSI all echoed the same opinion – that paper-based training would not positively influence ERP implementation success because it provides only generalized training.

On-the-Job Training.

The interviewed managers partially supported on-the-job training, giving this concept the second highest score among the various methods to conduct training. The interviewed managers explained how on-the-job training and reinforcement helps overcome both user resistance and workarounds. As one manager at YSI explained, “training has to be reinforced after ‘go-live’ because (end users) seem to forget – and that’s where we have to do a lot of cleanup, because they’re doing something wrong and nobody was really auditing to process to see the impacts.”

Additional Qualitative Findings

The researcher had many additional qualitative insights from the studied cases. However, while reporting all of the qualitative insights would result in a significant transfer

of information, it would also result in a completely unfocused treatment of these findings. Therefore, the researcher chose to focus on the six primary qualitative findings discovered during the course of this research. The researcher selected these based on how these findings affected other areas of interest from this study. Thus, the selected findings were the training environment and modularization (direct affect on job specific training), knowledge transfer strategy (examines exchange of knowledge from vendors to end users), readiness reviews (affects overall education and training effectiveness), education and training timeline (overall education and training timing and actions) and post-implementation normalization (affects resistance to change and improper system use or workarounds). Detailed explanations of each of these findings follow, starting with the training environment.

Training Environment.

In all cases, the companies used a copy of the actual ERP system or equipment to conduct primary training in the classroom. This carbon copy 'sandbox' environment enabled employees to 'do' their actual jobs in a controlled, realistic training environment that aided the learning process. After the classroom training was completed, employees were encouraged to 'play' in the sandbox to enhance their learning and understanding of the system. In addition to enabling job specific classroom training and providing a self-paced, realistic learning environment, using a copy of the ERP system for training had other benefits.

For example, Appleton populated its copy of the actual ERP system with 'real' company data and updated the copy whenever the actual ERP system received updates. As the interviewed managers from Appleton explained, having a representative system available

for training rather than a generic system allowed employees to ask realistic questions about how to complete jobs and "identified several areas where steps were forgotten." As a result, Appleton's classroom training program also doubled as an expanded testing of the system. As one Appleton manager explained, "having the sandbox available made the system better – either that or we would have found the problems after going live."

The interviewed end users also appreciated having specific, realistic training using a copy of the real equipment and ERP system. As a warehouse worker from NCR explained, "I liked that in the classroom we had the (bar code scanning) gun right there with you, you went step-by-step through the job using the manuals and they showed us, 'this is how you do it' and then let us practice doing it." The two other end users interviewed during this research echoed this same sentiment in various forms.

Training Modularization.

Several of the studied cases used modularized training sessions to limit both the time and quantity of knowledge needed for training. The interviewed managers explained how reducing training to only what an employee needs to accomplish the job allows the training to be more realistic, and thus, more effective. Indeed, managers at both Appleton and Cisco expressed that the use of a specific, modularized and progressive learning model provides a deep-learning experience for the end-users and greatly influences the overall success of an ERP implementation.

Knowledge Transfer Strategy.

While the interviewed managers provided strong support for the train-the-trainer method of end user training, in reality end user training is the last step of the training

process. This being the case, a great deal of prior knowledge transfer and learning must occur before beginning an end user training program. Fortunately, the interviewed managers also provided an overall roadmap of how training and knowledge should flow from the third party vendors to the end users. Figure 8 provides a generalized knowledge transfer strategy developed from the studied cases.

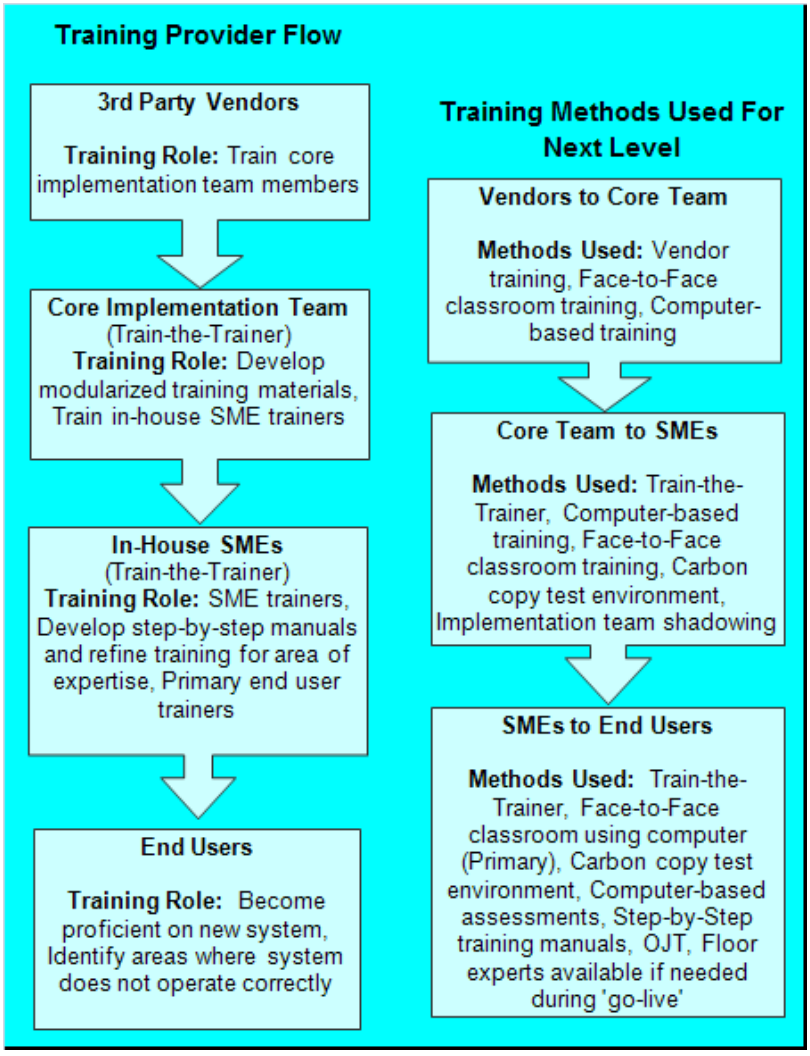


Figure 8. Generalized Knowledge Transfer Strategy

As Figure 8 shows, the most common knowledge transfer strategy involves four steps. First, knowledge flows from the ERP vendors to the primary implementation team

members. This team then creates modularized training and trains the SMEs through a combination of face-to-face (both classroom and shadowing) and computer-based training. The organic, in-house SMEs become the primary trainers for end users, adapt the implementation team training to their area of expertise, and create job/role specific training manuals. Finally, the end users receive and use the training, identifying areas where the system does not work as expected.

Some deviations to this generalized strategy did exist. For example at YSI, the implementation team members also created the training materials and manuals and were the primary end user trainers (SME / Implementation Team steps combined). Another difference came from NCR's training strategy, where the corporate, in-house and SME trainers were all involved in end user training (collaborative training). Despite these modifications to the general knowledge transfer strategy shown in Figure 8, the overall concept of training and knowledge flowing initially from vendors and then throughout the company via in-house employee trainers to the end users remained constant.

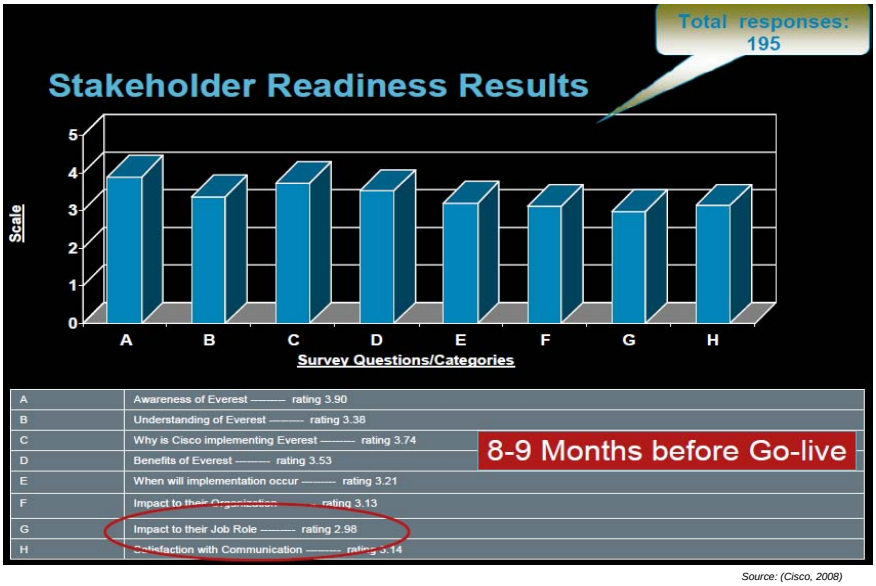
Readiness Reviews.

One finding that influenced the effectiveness of both the education and training programs was readiness reviews. Several of the studied cases either used a form of readiness review, or indicated that a lesson learned was to perform these reviews. The benefit of measuring the end users' readiness for ERP implementation is that closing the communication loop enables targeted changes to the education and training programs. As one Cisco manager explained, "We ask people how they feel about the new system

starting about nine months before ‘go-live’, because you need to know if people understand what you are trying to do.”

Initially conducting these reviews well before ‘go-live’ enables the ability to focus on problem areas. As the Cisco manager put it, “If the ratings are low, you have to figure out how to address it. If you wait to do (the readiness reviews) until the end, there’s no time to address it.” The manager continued, highlighting a current example, “We were doing some transformation changes recently and we did some readiness checkpoints – huge chaos. We literally had to go back and to restart the change management and push it hard.”

As the Cisco manager explained, making sure end users are ready to use the new system is vital to ERP implementation success. He added, “We’ve learned that if a project has 50 things to do and this one thing (organizational adoption) fails, it shuts down the whole thing, so we make sure we give it time.” Figure 9 provides an example of an education program readiness review score sheet used by Cisco implementation managers.



Source: (Cisco, 2008)

Figure 9. Education Program Readiness Review Example

Although Figure 9 provides an education program example, this concept can easily be adapted to a training program. For example, ILT exit surveys and direct classroom feedback can help identify areas where the training program failed to meet user expectations and/or needs. The study previously presented the concept of user feedback and its training and ERP implementation benefits during this chapter's discussions of asynchronous CBT vs. ILT and the training environment and strategy.

End User Education and Training Timeline.

Beneath a company's overall ERP education and training strategy is a strategic timeline. This timeline lays out the expected start and completion times of the education and training efforts. Generally, an education program starts early and happens in progressively more detailed waves. The goal of the education program is to help overcome the potential education-related problems, including gaining user acceptance and buy-in, developing user understanding and expectations of the system and overcoming end user resistance to change.

The purpose behind a multi-time, progressive education strategy, as one interviewed manager from Cisco explained is, "because you can't get it all in one sitting. People need to get some information, have time to absorb what you tell them, and then get new information." Further explaining this thought, he provided, "If you try to give it to them all at once, it won't work because they won't remember it all and they'll get frustrated. So we give them information in waves that get progressively more detailed." Most studied cases echoed this philosophy, including Appleton, YSI and Avery who all began general ERP education at a very early stage to allow for an evolving education program.

Training, on the other hand, usually follows a recency strategy with end users receiving training as close to 'go-live' as possible. As several interviewed managers pointed out, some preliminary training, such as general navigation and computer-use, may precede primary end user training. However, the majority of the job specific end user training usually falls very close to 'go-live'. Having training in two parts was, as one NCR manager reasoned, "Because you can't do it in one training session; so we broke it up to give them some advance notice so they can think about it a little beforehand."

The study provided many explanations of the benefits this strategy provides to both the end user and for overall ERP implementation success during proposition seven testing within this chapter. These benefits include higher user proficiency and training on a more 'stable and set' ERP system. Figure 10 provides a generalized end user education and training timeline developed from the studied cases.

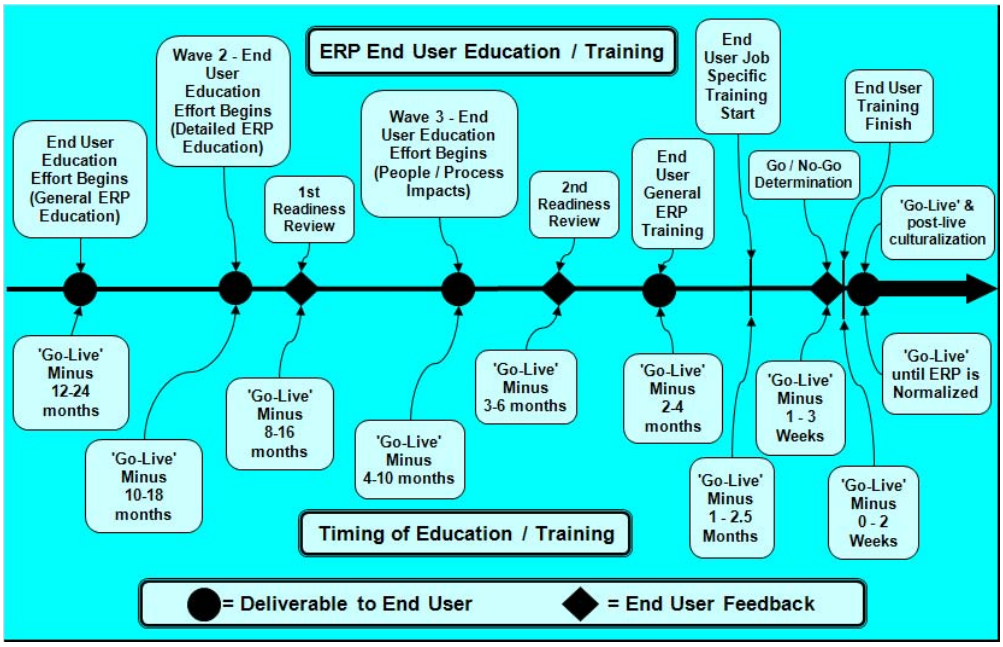


Figure 10. Generalized End User Education and Training Timeline

As Figure 10 shows, in general, the studied company's education programs began very early (12-24 month before 'go-live') and continued providing increasing details about the ERP system and how this system will affect the end users. For some cases, the effectiveness of the education program was periodically tested (via readiness reviews) to determine the overall end user support and understanding for the new ERP system. Conducting readiness reviews after major education efforts allowed the ERP implementers to focus on problem areas within the education effort and address these areas prior to beginning training.

End user training, on the other hand, began relatively late in the ERP implementation process. Typically 2-4 months prior to 'go-live', a company provided general ERP system training, including any additional training an end user may require (basic computer use / word processing, etc.). Around 1-2 months prior to 'go-live', this training (for the studied cases) was followed with job specific classroom training led by in-house SMEs. The job specific training effort ended just prior to 'go-live' for all studied cases. To verify training effectiveness and ensure end users were fully prepared to 'go-live', a final go / no-go readiness review occurred around 1-3 weeks before the system 'go-live' date. This final check gave the ERP implementation team a final look at the organization's readiness for the ERP system and offered the implementers a last chance opportunity to determine whether to postpone or 'go-live'.

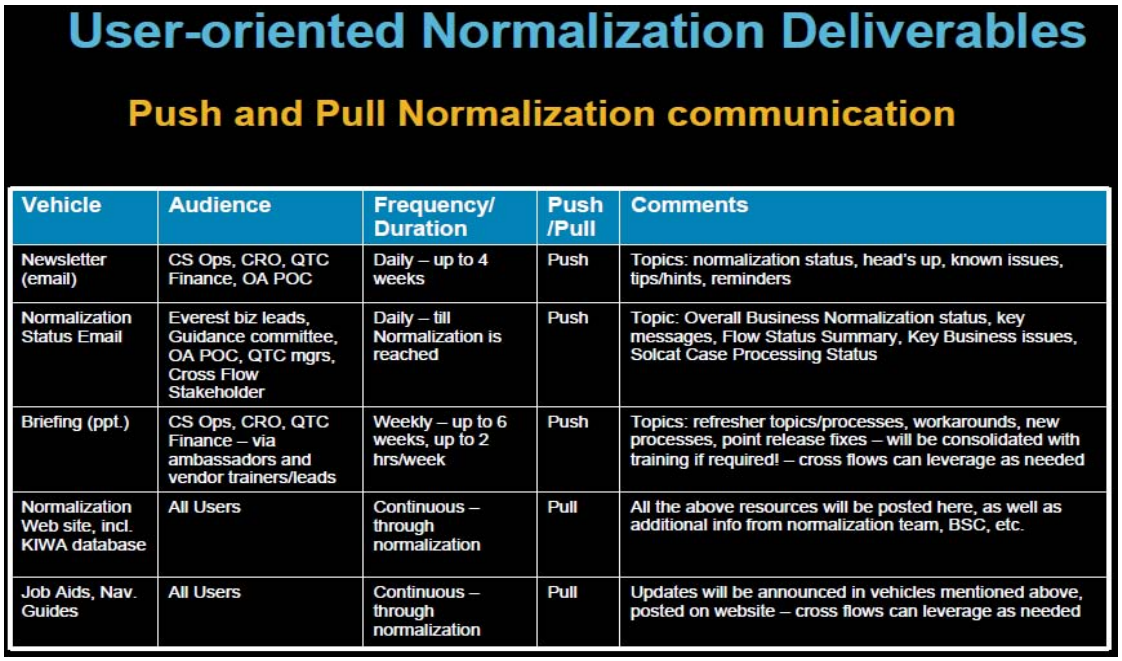
Post-Implementation Normalization.

Among the studied cases, post-implementation education and training or lack thereof was an area where respondents felt they had excelled, or a lesson learned /

improvement opportunity for their next large-scale IT implementation. Several interviewed managers considered this 'Normalization' period as essential to locking the new culture and processes into the company's daily routines and practices. Based on the studied cases, normalization is not an instantaneous occurrence but rather often lasts for weeks or months after 'go-live'.

One example of a standardized normalization process came from Cisco. For Cisco, normalization comes in two parts. First, employees receive integrated support from various areas (such as IT, business support, organizational adoption, online sites and change ambassadors), to help overcome initial problems and adoption needs. Because Cisco's implementations are global, the integrated support must be able to operate during the business hours of any of its global locations. To overcome this problem, Cisco uses a 'follow the sun' model and strategically places call centers around the globe to ensure support is available to any of its global locations at any time. An alternative method, used by several of the studied cases, would be to have a centralized support center operating 24 hours / 7 days a week.

For the second half of the normalization effort, Cisco uses a push-pull communication strategy to both provide employees with important updates and to give them a central source for reference materials. Materials provided during this effort include newsletters, job guides, workarounds, known problems and other presentations. This effort continues until Cisco achieves system normalization and the new system becomes full adopted for daily operations. Figure 11 provides an example of the push-pull communications Cisco provides during normalization along with the standard timeframe for these releases and the intended audience of the communications.



User-oriented Normalization Deliverables

Push and Pull Normalization communication

Vehicle	Audience	Frequency/ Duration	Push /Pull	Comments
Newsletter (email)	CS Ops, CRO, QTC Finance, OA POC	Daily – up to 4 weeks	Push	Topics: normalization status, head's up, known issues, tips/hints, reminders
Normalization Status Email	Everest biz leads, Guidance committee, OA POC, QTC mgrs, Cross Flow Stakeholder	Daily – till Normalization is reached	Push	Topic: Overall Business Normalization status, key messages, Flow Status Summary, Key Business issues, Solcat Case Processing Status
Briefing (ppt.)	CS Ops, CRO, QTC Finance – via ambassadors and vendor trainers/leads	Weekly – up to 6 weeks, up to 2 hrs/week	Push	Topics: refresher topics/processes, workarounds, new processes, point release fixes – will be consolidated with training if required! – cross flows can leverage as needed
Normalization Web site, incl. KIWA database	All Users	Continuous – through normalization	Pull	All the above resources will be posted here, as well as additional info from normalization team, BSC, etc.
Job Aids, Nav. Guides	All Users	Continuous – through normalization	Pull	Updates will be announced in vehicles mentioned above, posted on website – cross flows can leverage as needed

Source: (Cisco, 2008)

Figure 11. Normalization Deliverables Example

In addition to end user support and communications, as the interviewed managers at YSI pointed out, cultural normalization includes verification and auditing to ensure employee training worked and that employees use the ERP system correctly. This final step in normalization is very important to the overall health of the ERP system. For example, without verification that employees are using the new system correctly, the possibility of undisclosed workarounds is very real. As one YSI manager said, "If something doesn't work, people don't ask, they try to do it the old way or workaround the system, so it's important to get the initial training – don't short-change that, but after the fact you have to be there to reinforce it and audit the processes to see if they're working."

The implication of this finding for an ERP implementation is that after 'go-live' a company should select a group of qualified individuals to audit the processes. These

individuals must understand how each area within the ERP system should work and how employees should input data. When they find quality problems, they should also provide training and guidance to help end users overcome these problems. For companies using the SME train-the-trainer approach, as all the studied cases did, the SMEs became uniquely suited to accomplish this role in-house.

Comparison of Findings to Proposed USAF ECSS Training Plan

The second half of this chapter presents a comparison of the proposed USAF ECSS end user training plan to the results of this study's proposition testing and the additional findings of this study. The source document the study used for this comparison was the Management Plan (End Users Training Plan), version 2, revision A, released 20 Feb 09 by CSC (CSC, 2009), hereafter referred to as the PTP (proposed training plan). To identify the LTO's primary areas of concern with the PTP, the researcher met with a business transformation specialist (learning consultant) from the LTO's organizational change management "training team" to help focus the PTP comparison on these areas.

The benefits of this collaborative, customer-focused comparison are two-fold. First, the LTO receives in-depth analysis of their primary concerns with the PTP. Thus, through analysis (and later recommendations), the researcher can provide 'the way forward' for desired, rather than researcher selected factors. This should have an overall positive effect on the value of this research to the LTO.

The second benefit for the LTO is increased validity of the findings. Because the current training plan is only proposed rather than established, the nebulous nature of the PTP's wording made precise comparisons with the research findings difficult. Thus, a

portion of the collaboration with the LTO's "training team" member was to verify the validity of the researcher's interpretation of the PTP. In addition to this confirmation, the researcher attempted to ground the comparison using excerpts from the PTP. The purpose behind these quotations was to provide further validation of the researcher's observations and to allow the reader to develop their own conclusions about the PTP's contents.

The comparison of the PTP with the literature and research findings answers the final investigative question; IQ_3 – *Based on the results of IQ_1 & IQ_2; how well does the proposed USAF ECSS end user training plan compare to the literature and methods used in industry?* The researcher compared nine LTO-defined areas of interest to the quantitative and qualitative findings of this study. Table 18 provides a list of the items the study compared to the PTP including the basis for this comparison. Following this table, the study provides a detailed description of how each item compares to the study's findings and then explains the overall strengths and weaknesses of the PTP.

Table 18. Items Compared to Proposed USAF ECSS End User Training Plan

Comparison Item	Basis For Comparison	Description
1. What to Train	Proposition 4 Findings, Additional Qualitative Findings, Literature	This item refers to what content is delivered to the end users
2. Who Should Train	Proposition 5 Findings, Additional Qualitative Findings, Literature	This item refers to the primary trainer of end users
3. How to Support Training	Proposition 6 Findings, Literature	This item refers to whether user guides or manuals are supplied to the end users during training
4. When to Train	Proposition 7 Findings, Literature	This item involves the planned timing of the training provided to the end users
5. How Long to Train	Proposition 8 Findings, Additional Qualitative Findings, Literature	This item refers to the length and flexibility of the overall training program
6. How to Train	Additional Quantitative Findings	This item refers to the overall methods used to deliver training to the end users
7. Training Environment	Additional Qualitative Findings	This item refers to the type of training environment the end users will have during training on the ERP system
8. Knowledge Transfer Strategy	Additional Qualitative Findings	This item refers to the knowledge transfer strategy from vendors to end users and SMEs
9. End User Education and Training Timeline	Additional Qualitative Findings	This item refers to the overall timing of the end user education and training programs

What to Train Comparison.

The two primary findings of the study were the fully supported proposition of job specific training (rather than general ERP system use) and the strong support for both SME developed and modularized training. As the PTP states, "The end user training curriculum will contain, as a minimum, ECSS Overview and Navigation. This is specified in the PWS (Performance Work Statement)" (CSC, 2009). The PTP goes on to add that curriculum development has not yet occurred and awaits the outcome of a training analysis.

Several areas in the PTP lead the reader to believe that future revisions of the PTP will base this training on an end user's specific role in the overall ERP process. For example, as stated in the PTP, "On the job, AF members perform many different roles. For this reason, ECSS end user training will be based on those tasks associated with specific roles, rather than positions or jobs" (CSC, 2009).

Who Should Train Comparison.

Both the findings of this research and the literature strongly supported the use of organic, in-house SMEs as end user trainers using a face-to-face, train-the-trainer philosophy. There were many reasons for this, primarily the development of in-house expertise and increased levels of end user acceptance and buy-in. The PTP states, "Team CSC will provide the instructors for instructor-led training," (CSC, 2009), but does not say whether these are organic in-house USAF SME trainers or civilian, non-organic trainers. In the absence of other evidence, the researcher assumes the latter.

There are provisions in the PTP for organic USAF SMEs to assist with training of end users receiving blended CBT/ILT. As stated in the PTP, "Some Super Users may be

considered for supporting roles in end user training or play key roles in ensuring end user training success at the local installation level by either becoming classroom instructors or by aiding classroom instructors" (CSC, 2009). The researcher presumes that these SME assistants will come from the pool of 5K super users trained using blended CBT/ILT and may assist with the training of the remaining 20K users receiving blended CBT/ILT learning. The PTP indicates that the remaining 225,000 end users will receive training through CBT-only and thus have PCs as the primary trainer.

How to Support Training Comparison.

The literature and research findings also strongly supported the use of training manuals to support training. As the researcher discovered, these manuals should not be theory-based, but rather specific step-by-step guides that help develop 'a day in the life of business' for the end user. The PTP provides several descriptions of the training materials that will support end user training and indicates that these manuals will become more specific during content development. As the PTP states, "Later in the Development phase, more refined training materials will be created or completed, such as work instructions, exercises, simulations, and participant guides which must reflect the final configuration of ECSS business processes and system configuration and architecture" (CSC, 2009).

When to Train Comparison.

Regarding the training of end users, the literature supported and the findings of this study partially supported training just in time before 'go-live'. Completing training after 'go-live' was fully refuted by the interviewed managers and considered a very negative influence on the overall success of an ERP implementation. The PTP begins

user training with ECSS Navigation Training via CBT approximately three months prior to ‘go-live’. According to the ‘ECSS End User Path to Competency’ (PTP Figure 5.4.4-1), following this general navigation training end users will receive additional assigned training starting around two months prior to ‘go-live’ and finishing around two weeks after ‘go-live’ (CSC, 2009).

How Long to Train Comparison.

How long refers to a quality in training of flexibility (changes as the ERP system changes) that end users are able to re-visit as needed in a continuous fashion. This concept received support from the literature and overall received partial support from the studied cases. The PTP provides for end user and instructor feedback to enable flexible, changing training and states, “The success of ECSS end user training is, in part, dependent upon complete and up-to-date training materials” (CSC, 2009). The PTP also addresses the need for updating end users through communication to ensure they have the latest training and understanding of ECSS.

How to Train Comparison.

The study measured four ways to train, asynchronous CBT, face-to-face ILT, paper-based training and on-the-job training. These factors varied from not supported (asynchronous CBT / paper-based training), to partially supported (on-the-job training) to fully supported (face-to-face ILT). The PTP puts a heavy reliance on CBT-only (90%) as indicated by “Preliminary design considerations lead to a target audience for CBT of 225,000 end users.” The PTP states that the remaining 25,000 users will receive blended CBT/ILT similar to the training provided by Cisco and Appleton. The interviewed

managers from the studied cases did not support that primary training should come from CBT-only and strongly supported ILT as the primary training method. The heavy use of CBT-only was the strongest disconnect between the PTP and the findings of this research.

Training Environment Comparison.

The training environment involves the ERP system or equipment used to train the end users. The environment can be anything from a paper-based theoretical system to a vanilla-generalized ERP system to a copy of the actual production ERP system. The interviewed managers from the studied cases all strongly believed in using a carbon copy of the production ERP system during training for all end users. The primary reason for this belief was that training using a copy of the actual production system reduces the end users' uncertainty and resistance to change and enhances end users' understanding of how to do their jobs in the new system.

The PTP indicates it will use an up-to-date copy of the production ERP system for the sandbox environment. This training environment appears linked to end users receiving classroom training and thus is only applicable to the 25K end users trained via ILT. The researcher makes this conclusion from PTP Table M-6's description of sandbox operators as core users and several PTP phrases (CSC, 2009) including:

> "(Sandboxes are) the databases *used by trainers and participants* during ECSS training sessions"
>
> "Enough data will be created to allow each participant *in every class* to carry out an ECSS task independently"
>
> "Participants will access the Training Instance databases *during hands-on classroom activities* after viewing an instructor demonstration"

Knowledge Transfer Strategy Comparison.

The general knowledge transfer strategy followed by the five studied cases involved initially training a core in-house implementation team by third party vendors. This step brought the ERP implementation knowledge in-house and enabled organic, in-house personnel to control the knowledge transfer throughout training development and delivery. Generally, once the expertise was in-house, knowledge transfer was a three-step process that flowed from the core implementation team to the SME trainers to the end users. The PTP deviates from this generalized knowledge transfer strategy as seen in Figure 12.

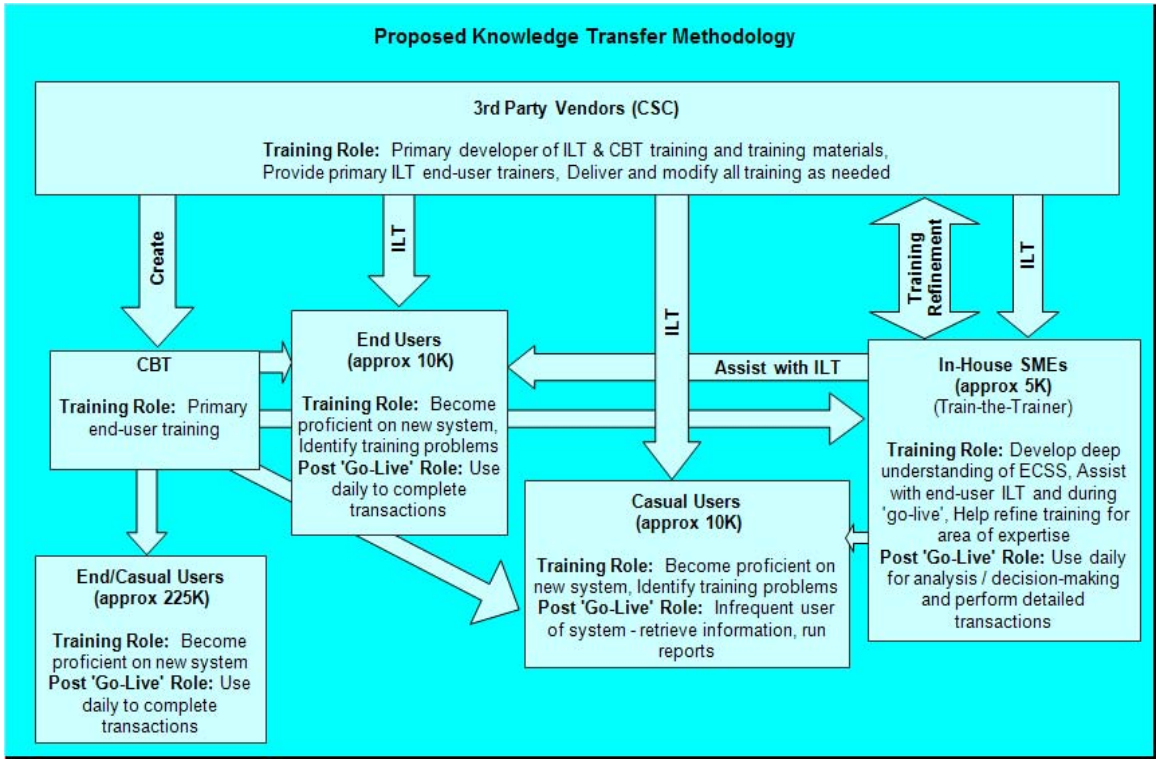


Figure 12. PTP Knowledge Transfer Strategy

As seen in Figure 12, the primary deviation from the generalized knowledge transfer strategy presented by this study is the third party vendors controlling the knowledge transfer at all stages. The blended CBT/ILT learning provided by CSC is similar to the methodology used at Cisco and Appleton, but differs in that the primary trainer remains at the vendor level with SME trainers playing a support, rather than primary, end user training role. Another major difference from the findings of this case is the proposed use of CBT-only as the primary means of knowledge transfer (affects 90% of all ECSS users) to the end users, rather than the organic train-the-trainer ILT methodology used by all studied cases.

Education and Training Timeline Comparison.

The education and training timeline provided by the PTP (PTP Figure 5.4.4-1; CSC, 2009) is very similar to the generalized education and training timeline developed from the studied cases. As in the generalized timeline, the PTP education effort will begin early and progress from generalized ERP education to detailed ERP information. Another similarity to the generalized timeline is the time between education deliverables. The education effort described by the PTP will come in waves and give the end users around three months to absorb the new information before starting another education push. The PTP education timeline appears to address, as a minimum, new business processes, job impacts and the importance of data accuracy to up- and down-stream activities.

The two-part training program described by the PTP timeline (moving from general → specific training) is also very similar to the generalized timeline, as are the post-implementation efforts described in the timeline. End user training also falls

within the generalized parameters and starts approximately 2½ months prior to 'go-live'. A slight disconnect from the literature and studied cases is the end user training stop timing (around 2 weeks after 'go-live'). Also missing are any indication of the timing of end user education readiness checks (if the PTP plans these checks). The use of training effectiveness evaluations, which the PTP describes (PTP Chapter 5.5) as occurring during the 'evaluate' phase after training rollout, appears to be the PTP's version of training readiness checks (CSC, 2009).

Strengths and Weaknesses of the PTP.

Analysis of the strengths and weaknesses of the PTP was vital to help the researcher develop policy recommendations in Chapter V of this study. The identified strengths and weaknesses of the PTP primarily came from the case study findings and included literature support when applicable. The researcher marked areas as strengths when they matched the positive findings of the study or opposed identified training weaknesses found in the studied cases.

The strengths of the PTP included role specific training, involvement of SMEs in ILT training and training development, the use of user guides and the sandbox environment, the flexible, adaptable and continuous training and the overall end user education and training timeline described in the PTP. Table 19 provides a complete list of the strengths of the PTP identified during this study, including the LTO focus area(s) and a detailed justification for the classification.

Table 19. Strengths of the PTP

Strengths of PTP:	Focus Area(s)	Justification for Classification:
1. Role Specific Training	What to Train	Job specific training was strongly supported in both literature and by the studied cases. Every one of the interviewed managers rated providing specific training to the end users as very positively influential on overall implementation success. The PTP indicates that, although the training has not been developed, training will focus on specific user roles. Done correctly, this training will deliver 'a day in the life' of the user and provide the job-specific training needed for successful ECSS implementation.
2. Involvement of SMEs in Training Development	What to Train, Knowledge Transfer Strategy	Using SMEs for training development was strongly supported by the literature and the findings of this study. SMEs are uniquely able to develop job specific training that is relevant to their functional areas and can develop the links between how the old system was used how to complete their job in the new system. Using end user SMEs to create training was also shown to help develop buy-in for the new system at the 'touch labor' level.
3. SME Involvement in ILT	Who Should Train, Knowledge Transfer Strategy	SME involvement in end user training was very strongly supported by the literature and studied cases. The benefit these trainers provide to an organization, in addition to increased user buy-in and in-house expertise, is that these trainers understand the end users' jobs and can speak in terms the end users can understand.
4. User Guides	How to Support Training	Although not yet created, the PTP states that manuals will reflect the ECSS business processes and system configuration. According to the literature and studied cases, these manuals need to be tailored to end users' roles and positions and reflect 'a day in the life' of a user. These manuals should also be centrally controlled but locally available (computer-based) to ensure standardization and updated frequently to keep the manuals applicable.
5. Flexible, Adaptable & Continuous Training	How Long to Train	The PTP provides both user feedback routes and addresses the need to modify training and communicate these changes continuously as the ECSS system is altered. This flexibility and communication strategy should help users adapt to system problems or fault found in the overall training program.
6. Use of Training Sandbox	Training Environment	The PTP indicates that a sandbox (copy of production ECSS) environment will be used during ILT both during instruction as exercises and after instruction for user practice and knowledge development. This training environment was strongly supported by the studied cases and was credited with many positives, including increasing user understanding and buy-in and identifying system problems prior to 'go-live'.
7. Overall End User Education and Training Timeline	Training Timeline	The overall education and training timeline (ECSS End User Path to Competency; CSC, 2009) appears sound. The plan indicates a phased education program, followed by a two-step training process (General → Specific). Post-'go-live' support also appears to be addressed. Overall, the education and training timeline appears very similar to the studied cases.

Similar to the strengths found in Table 19, the study analyzed the PTP for weaknesses. The researcher classified areas as weaknesses where they either opposed the positive findings of the study or matched identified weaknesses. The weaknesses of the PTP included the potential minimum training level, primary vendor and CBT-only training of end users, the PTP blended knowledge transfer strategy, training timing and use of the training sandbox. Table 20 provides a complete list of the weaknesses of the

PTP identified during this study, including the focus area(s) and a detailed justification for the classification.

Table 20. Weaknesses of the PTP

Weaknesses of PTP:	Focus Area(s)	Justification for Classification:
1. Minimal training level (ECSS Overview and Navigation)	What to Train	The minimal training level described by the PTP was not supported by the literature or studied cases. Although in 2 of 5 cases, providing minimal training was considered better than providing no training, the remaining cases rated minimal training as negative to the overall ERP implementation effort. The researcher did not find an indication of the likelihood of this minimal training occurring and thus assumes this level of training is unlikely.
2. Vendor-provided trainers as primary ILT end user trainers	Who Should Train, Knowledge Transfer Strategy	Although at some point vendor-provided training is both necessary and proper, using vendors as primary end user trainers severely limits the knowledge transfer process. The PTP training strategy indicates that only 5K super user trainers will be developed (high-level knowledge transfer) through ILT. This means only 2% of the ECSS end users will receive the in-depth knowledge transfer that both the literature and the studied cases indicated was critical to an ERP's success.
3. Primary CBT training of end users	How to Train, Knowledge Transfer Strategy, Training Environment	According to the PTP, 90% of ECSS users will only be CBT trained . Using CBT as primary training was not supported by any of the studied cases. As stated in the literature and repeated throughout the studied cases, how you train is important and cutting corners in this area can be disastrous. In addition, if the CBT training does not also provide these end users with access to the training sandbox, as the PTP seems to indicate, these end users may not be familiar with the 'actual' system when it goes-live.
4. PTP Blended Knowledge Transfer Strategy	Knowledge Transfer Strategy	The blended end user knowledge transfer strategy using CBT/ILT affects only 25K end users. The PTP proposes that this CBT/ILT blended knowledge transfer will train 5K super users (SMEs), 10K end users and 10K casual users. Given the limited ILT resources offered in the PTP and the importance of organic in-house expertise to overall implementation success, this plan seems to focus on ILT training for end and casual users rather than increasing the pool of trained SMEs.
5. Training Timing	When to Train, Training Timeline	ECSS end user training is scheduled from 1 1/2 months prior to approx. 2 weeks after 'go-live'. While the 1 1/2 months prior start time is certainly acceptable given the potential constraints on training resources and time, the literature and studied cases strongly refuted completing training after 'go-live'.
6. Use of Training Sandbox	Training Environment	Although the PTP indicates that ILT students will have sandbox access, both during and post-training, the researcher found no evidence in the PTP that end users educated via CBT-only would receive this access. All studied cases provided sandbox access to all end users as a medium for familiarization and practice with the 'production' ERP system.

Summary

This chapter provided the aggregated data analysis and findings of the case studies. The chapter presented these findings for all eight hypothetical propositions; answering IQ_2 and providing a basis for an answer to IQ_3. In addition, the chapter provided the general links between an education program and education-related

problems, and the specific links between a training program and training-related problems. In addition to the testing of hypothetical propositions, this chapter also provided several additional findings, primarily 'how to train' and a generalized knowledge transfer strategy and education and training timeline. Next, the chapter answered IQ_3, comparing the ECSS PTP to the findings from the literature and the methods used in by the five studied companies. In developing this answer, the study thoroughly analyzed nine aspects of the PTP and provided both a comparison of the PTP to the findings of the research and the strengths and weaknesses of the current PTP. The next chapter provides the overall conclusions and an answer to the overall research question (*How should the USAF provide education and training to the touch labor end user employees to best support the ECSS implementation effort*) by explaining policy recommendations for ECSS.

Chapter V. Conclusion

Overview

This final chapter provides the general implications of an effective ERP implementation education and training program and a synopsis of some of the important findings examined during the analysis and results chapter of this study. Based on the comparison and analysis of the study's findings with the PTP, the researcher then provides an answer to the overall research question (*How should the USAF provide education and training to the touch labor end user employees to best support the ECSS implementation effort?)* by developing recommendations for ECSS education and training efforts. Following these recommendations, the chapter explains the assumptions and limitations of the research and then concludes with lessons learned and implications for further research.

General Implication of Education and Training Findings

The general implication of the education and training findings are that companies must properly manage these programs if they desire successful ERP implementations. Based on the results of the five studied cases, the study previously discussed the overall impact a company's education and training programs have on ERP implementation success. The following is a brief synopsis of the detailed findings from the analysis and results chapter of this study.

The interviewed managers all rated the various studied parts of a company's education program as either a positive or a non-influential factor towards overall ERP

implementation success. The studied cases also provided links between the education program's people-, process- and technology-motivated efforts to various education-related problems. Problems, such as failing to meet user expectations, low user buy-in and acceptance, resistance to change, etc., are all affected by the effectiveness of a company's ERP education program (positively or negatively). As the studied cases indicated, this was especially true with user acceptance and buy-in, a critical success factor for ERP implementations.

Similarly, as seen in the literature and in the selected cases, a company's training program greatly affects the success of an ERP implementation. One of the largest impacts comes from the choice of who should train. For example, all of the selected cases employed in-house SMEs using a train-the-trainer methodology for primary end user training. This methodology has strong direct links to potential training-related problems (lack of acceptance/buy-in, lack of in-house expertise). In addition, these SMEs are uniquely able to understand how the changes to the business processes truly affect in-house employees and thus the choice of who should train impacts the effectiveness and creation of job/role specific training and user manuals.

In addition to the education and training propositions the study explored, the researcher discovered many additional findings that interacted with and affected these propositions. Among these, the key findings were the importance of face-to-face classroom training and an effective knowledge transfer strategy from vendors through organic SME employees to the end user. The study also identified other findings such as training modularization (affects ability to conduct job specific training), readiness

reviews (measures user understanding and buy-in) and post-implementation normalization (locks new system into company culture).

Recommendation for ECSS Education Effort

The PTP did have some references to education, mostly referring to the end user education timeline and education around new business processes and job impacts. However, the researcher did not find enough information about the proposed education plan within the PTP to make a true comparison with the study's findings. From the PTP education and training timeline, it does appear that the ECSS education plan involves the 'best practices' methodology from the studied cases of educating in waves of increasingly more specific detail and providing time between education waves to absorb the information.

The primary education-related item the researcher felt was missing from the PTP was timing for end user education readiness checks. This information may be contained in the PTP but if so, it was not evident to the researcher. Therefore, the researcher developed the following recommendation based on this perceived lack:

1. ***Conduct Education Readiness Reviews.*** Addressing end users' reluctance to change and lack of acceptance of and buy-in to the ERP system begins with end user education. Checking the effectiveness of an education program through closed-loop end user feedback methods, such as readiness reviews, enables education program modifications that focus on end user needs. For ECSS, as a minimum, these checks should occur shortly after major education efforts (ECSS business processes, user and data role overviews) to identify

end user indicated shortfalls in the education effort and to allow changes before the next wave in the education program.

Recommendations for ECSS Training Effort

Comparisons between a 'proposed' end user training plan and research findings are much more difficult than with an established training plan. However, the benefit of conducting this comparison prior to formal establishment of a concrete training plan is the capability of more easily making changes. With this benefit in mind, the researcher makes the five following recommendations for the ECSS PTP end user training effort:

1. ***Avoid Minimal Training for End Users.*** The minimal training level described by the PTP includes ECSS overview and navigation only. Minimal, generalized training was linked in the literature to ERP failure and was considered moderately negative to the overall ERP implementation success by the interviewed managers. Although, as the PTP states, this minimum level was authorized by the PWS covering ECSS, the USAF should strongly avoid minimizing training to this level. With the exception of casual users of the system, whose overall impact on ECSS implementation success should be very low, this minimal level of training is not appropriate. Based on the literature and studied cases, end users and SMEs should receive, as a minimum, job- or role-specific training reflective of 'a day in the life' of their job.

2. ***Modify Knowledge Transfer Strategy.*** The current PTP knowledge transfer strategy uses either vendor-provided trainers or CBT-only as the primary end

user trainers. In-depth knowledge transfer, according to the PTP, affects only 5K (Super User/SMEs) or 2% of the estimated 250K end users of ECSS. While this training strategy *may* be effective at enabling end users to operate ECSS, it severely limits the USAF level of organic, in-house expertise on the system.

Both the literature and studied cases indicated a strong need for in-house expertise and strongly linked this expertise to in-house SME trainers. The general knowledge transfer plan for all studied cases was from vendors to in-house ERP implementers to in-house SME trainers to the end users. This strategy may not be appropriate for the USAF given the vendor, rather than in-house, implementation of ECSS. However, the researcher recommends that the USAF consider adopting a shortened knowledge transfer strategy, i.e. vendors to organic USAF SME trainers to end users. The researcher considers this strategy superior to the current primary knowledge transfer strategy of vendor provided or CBT-only. The researcher contends that using this method would result in greater levels of organic USAF ECSS proficiency and greater flexibility for USAF training development and delivery to end users.

3. Modify ILT Training Strategy. The literature and the studied cases strongly supported using ILT as the primary end user training method. In some cases CBT was used to prepare end users for ILT and then for refresher training after ILT. However, none of the studied cases used a CBT-only strategy as

the primary end user training method. As no studied case supported or used the ECSS PTP of 90% (225K end users) receiving CBT-only and 10% (25K end users) receiving blended CBT/ILT training, the researcher cannot fathom the outcome this methodology will have on the overall success of ECSS.

The researcher assumes that using ILT for only 25K ECSS end users is a cost reduction strategy. If this is not the case, the researcher recommends all ECSS SMEs and non-casual end users be trained via a blended method of CBT/ILT. If, as supposed, providing ILT for only 25K end users is a cost reduction strategy, one might expect that only the most critical end users would receive this training. However, the PTP indicates that 40% of the target ILT population (10K) will be only casual (infrequent) users of ECSS.

The researcher strongly believes that the ILT strategy and target population requires rework and fully recommends that, given the limited number of available ILT seats, neither basic end users nor casual users be trained using ILT. Under the 25K user ILT constraint, the USAF should reserve ILT training for identified USAF SMEs and provide these users with in-depth ECSS training. In this researcher's opinion, proper use of the limited ILT seats to develop a larger pool of USAF ECSS expertise is critical to overall ECSS implementation success, even if this means reducing the overall total number of end users receiving ILT below 25K.

4. Open Use of Training Sandbox for all Users. The PTP indicates that users who receive ILT will also receive access to a copy of the ECSS production

system (training sandbox) for practice and knowledge development. The researcher was unable to determine from the PTP whether users receiving CBT-only will also have access to this sandbox environment, but based on PTP comments (provided during the analysis and results chapter), assumes this is not the case. Based on the importance the studied cases placed on using the sandbox environment both during and after training, the researcher recommends providing sandbox access to any ECSS end user who has completed training, blended CBT/ILT, CBT-only or otherwise.

5. ***Modify End User Assigned Training Timing.*** The current PTP indicates that the timing of end user training (non-generalized training) is from 1½ months before to 2 weeks after 'go-live'. The findings of this study indicate the PTP end user training start time is certainly within the generalized timeline. However, all studied cases *completed* training prior to 'go-live' and felt that not completing training prior to this time, as the PTP indicates, was very negative.

The PTP training completion date may reflect the very real chance that there may be some unfinished initial end user training after 'go-live' due to unanticipated circumstances such as rapid deployments, illnesses, other training, etc. However, based on the literature and findings from the studied cases, the researcher contends that the PTP should not **plan** to have initial end user training unfinished after 'go-live'. Weston (2001) provided a strong warning that setting an arbitrary 'go-live' date "before users are fully trained

and ready is a death trap." Therefore, the researcher recommends that the USAF either move the planned training completion date forward (to at least 'go-live') or push the planned 'go-live' date back (to the current training completion date).

Assumptions/Limitations of Research

This research attempts to provide an accurate blueprint of the critical ERP education and training success factors from literature and then test them against selected cases and compare them to the ECSS PTP to develop recommendations for the USAF ECSS implementation strategy. However, this blueprint comes with both assumptions and limitations. A researcher would be remiss not to state these limiting factors to allow the reader to make their own judgments about the quality and accuracy of the research results. To avoid the error of failing to disclose potential problems within the study and to provide the reader with the researcher's overall viewpoints when conducting the research, the study defines the following assumptions and limitations:

1. ***Missing ERP Implementation Education and/or Training Success Factors.*** The study used many sources from the literature to develop the education and training success factors and the propositions developed from these factors. However, the author must allow that some subjectivity in the interpretation of what the literature considered success factors occurred. The result of this, as the researcher discovered during the analysis portion of this study, was the research omitted several important success factors. These include (but are not limited to) how to train, the training environment and knowledge transfer strategy. The impact of

this is that some critical education and/or training success factors still require further study and analysis, including empirical, quantitative data collection of these factors.

2. ***Only Assesses Education and Training Portions of ERP Implementations.*** This limitation stems from the fact that the study only considered the education and training factors of an ERP implementation. The study accepts that proper education and training is only a portion of an overall ERP implementation strategy, and that other factors will affect the implementation success of an ERP system. However, despite understanding that other factors do affect an ERP implementation, the researcher assumed adequate management of these other critical success factors and the interactions between education, training and other factors was not measured.

3. ***Applicability Beyond Units of Analysis and/or Cases Studied.*** This research clearly focused on a micro-level view of the education and training used on the touch labor-level employees during an ERP implementation. Although several findings were consistent among the studied cases, there is no guarantee of generalizability beyond this level of employment in an organization (for example, to apply the findings to the middle- or executive-level). In addition, the potential exists for the findings of this study to apply only to the cases studied. If this is true, generalization to ECSS or any other organization implementing an ERP system may be impossible.

4. ***Potential for Researcher Bias*.** Although bias is possible in all types of research designs, the potential for research bias is one of the major criticisms of a case study design (Yin, 1989). To help overcome this potential, this study used a grounded theory paradigm that encouraged the researcher to explore rival theories that could explain the research findings (Patton, 2002). However, even the most rigorous of research designs still has the potential for bias, so this study must recognize this possibility and accept that the findings could reflect some measure of this potential.

Lessons Learned and Areas for Further Study

Although lofty goals and high expectations of valuable contributions to the overall pool of literature make great rhetoric, these goals are extremely hard to achieve, especially in the short span of a research project. Thus, the biggest lesson this researcher learned was the value of focused investigation, of which this research is not an example. This research attempted to find the important education and training factors from the literature, test these factors against multiple cases and then compare the results to the ECSS end user education and training plan for the USAF. However, properly accomplishing this task stretched the capabilities of the researcher and, as a result; many holes remain after completion of this study.

For example, the transcripts developed during the research helped identify many areas where further quantitative and qualitative investigation would have benefited this overall body of work. However, this larger investigation was not feasible given the time constraints of this study and its participants. Therefore, the researcher must accept that

some areas of this research inadequately describe the phenomenon the researcher observed and filling these gaps in understanding will require a great deal of further study.

Thus, the final lesson learned is while a researcher may desire to understand every portion of a research question, this is not possible. The benefit of this to future research is there are always additional areas to study. The researcher proposes the four following possible areas of interest for future ERP implementation studies:

- What are the best education methods to minimize education-related problems and maximize ERP implementation success?
- What knowledge transfer strategy best supports a successful ERP implementation?
- How do the methods a company uses to train employees help prevent or reduce the potential ERP implementation training-related problems?
- What are the internal connections between the potential ERP implementation education- and training-related problems?

These identified areas of further research are just a small sampling of the potential areas for further research in this subject. The reader of this research may have alternate and just as acceptable ideas. This researcher hopes this study spawns many interesting findings, identified or otherwise. Regardless of the direction that research in this area may take in the future, one thing is certain; this researcher has left many avenues for future research available.

Appendix A: List of Abbreviations and Acronyms

This listing provides a quick reference for the various abbreviations and acronyms used throughout the study. The paper initially spells all terms out before using the abbreviated form.

Abbreviation		Description
CBT	-	Computer-based Training
DoD	-	Department of Defense
ECSS	-	Expeditionary Combat Support System
eLog21	-	Expeditionary Logistics for the 21st Century
ERP	-	Enterprise Resource Planning
ILT	-	Instructor-Led Classroom Training
IQ	-	Investigative Question
IT	-	Information Technology
LTO	-	Logistics Transformation Office
MRP	-	Materials Resource Planning
OSD	-	Office of the Secretary of Defense
PC	-	Personal Computer
PTP	-	Proposed Training Plan
PWS	-	Performance Work Statement
SME	-	Subject Matter Experts (Used interchangeably with Super User)
USAF	-	United States Air Force

Appendix B: Introduction and Research Summary Letters

Introduction Letter

(Adapted from: Ellram, 1996)

Date:

Dear _____,

Thank you for talking on the phone with me on _____. I am really looking forward to my visit to _____ on _____. I truly appreciate your time and your willingness to host my visit. I plan to arrive at your facility at approximately _____ as you suggested.

I have included a brief research summary as well as a copy of the interview guide. These documents are guides for the overall interview process, and cover the host of topics I would like to discuss. Although the guide may seem long, I fully intend to take up no more than 1 ½ hours conducting the primary interview. As the implementation efforts for Enterprise Resource Planning (ERP) systems vary dramatically from company to company, understanding your company's implementation, from a training and education standpoint, is important to my research.

In addition to the primary interview, if possible, I would like to spend no more than 30 minutes talking with someone who uses your ERP system on a daily basis and was employed during the implementation of the system. Having a 'floor view' of the implementation process would be invaluable to rounding out my research findings.

Finally, if you have any general or specific information about the training and education programs you used during the implementation of your ERP system that you could send in advance, I would greatly appreciate this courtesy. Having this information would help me be better prepared for our visit.

Thanks again! Please call me at _____ or email me at _____ if you have any questions or concerns.

Sincerely,

Research Summary Letter

(Adapted from Ogden, 2003)

Focus of Study

The focus of the research is to determine the best methods to train one portion of the workers who will use the future United States Air Force, Enterprise Resource Planning (ERP) system, the touch labor employed in the USAF and military depots. The study uses a two-part research approach by first identifying the critical training & education factors, and then testing these factors against actual ERP implementations, like your company's, using case study research. Understanding your company's ERP implementation from a training and education standpoint is a critical portion of this second part of this research.

Purposes

1. Identify and understand the critical education and training success factors for implementing an Enterprise Resource Planning (ERP) system.

2. Develop a better understanding of education and training methods used by companies when implementing an ERP system.

3. Develop policy implications based on the knowledge gained about education and training methods used during ERP implementations.

Benefits to Participating Companies

Participating companies will be given in-depth results from the research, including their company's individual case study write-up and the overall research results. These results should lead to a greater understanding of the education and training success factors used and their impact on ERP implementation success. If requested, I will compile a report comparing the education and training efforts of your organization to the other participating organizations. This comparison may enable you to determine what methods to use when implementing new (or expanding existing) ERP systems or when performing some other large-scale transformation process in the future.

Privacy/Confidentiality

To increase the validity of the study and the acceptance of the findings, the study would like to identify your company as a participant in publications generated through

this research, unless you specify that your company wishes to remain anonymous. In either event, in order to ensure accuracy, transcripts of data collected during the interviews will be provided to the interview respondents so that necessary corrections or clarifications can be made.

Time Commitment / Time Frame

Case study research involves interviews with key respondents within organizations. As part of the research, I would like to interview a few individuals from your company. The types and number of people I would like to interview are:

Number of Interviews	Individual	Time Involved	Nature of Questions
1	Manager Knowledgeable about Training & Education Methods used during ERP Implementation	60-90 Minutes	● Types of Training & Education Used ● Timing of Training & Education ● Training & Education Lessons Learned ● Effectiveness of programs used
1	Touch Labor 'Floor Worker' who uses ERP System Daily & was Employed during the ERP Implementation	20-30 Minutes	● How the job changed ● Best practices ● Overall Impressions

These interviews will be face-to-face, on-site interviews. Follow-up questions, if necessary, will be handled via phone or e-mail. As I understand you have a busy schedule, any follow-ups will be kept to a minimum. As discussed, the interviews will be conducted on _____, at your location.

My goal is to complete the data collection phase of this research by January 1, 2009 and to submit the findings of my research to all participating organizations no later than March 15, 2009.

Appendix C: Interview Guides

ERP Education and Training Primary Interview Guide

(Adapted from: Ellram, 1996)

Primary Interview Flow and Definition Sheet

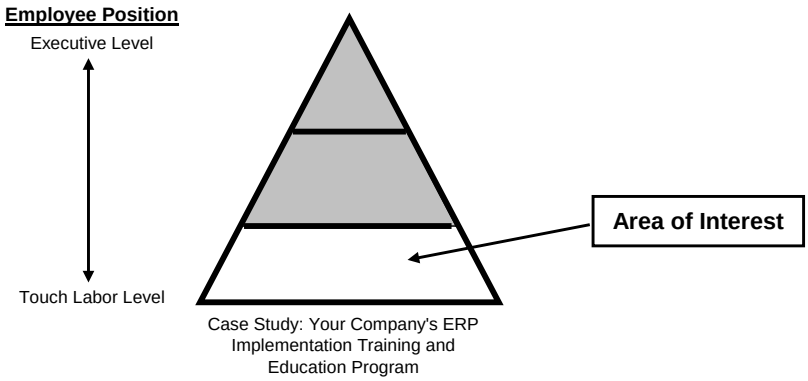
This sheet provides an outline of the basic flow the primary interview will follow and explains some non-standard terms and items from the interview guide.

Outline of Interview Flow

1. Background Information
2. Company's ERP Usage Questions
3. ERP Education-Related Questions
    a. Process
    b. Outcome
    c. Lessons Learned
    d. Influence of Education Factors
4. ERP Training-Related Questions
    a. Process
    b. Outcome
    c. Lessons Learned
    d. Influence of Training Factors
5. Implementation Outcome Questions
6. Wrap-up Questions

Non-Standard Terms and Definitions

1. **'Touch Labor'** – The study defines the touch labor-level employees as the floor workers who are directly responsible for creating your company's product / providing your company's service to the consumer. The picture below shows the employee area of interest of this study:



2. **ERP Education** – As stated in the interview guide, this study considers education to be the 'people-and-process' portion of ERP learning. This study defines ERP education as 'anything that *helps employees to understand the ERP system* that is not related to showing them how to use the system.' For example, education includes explaining what an ERP system is, why the company is implementing the system, how the system will affect employees, etc.

3. **ERP Training** – In contrast to education, ERP training is the 'keystrokes and transaction' teaching that *shows an employee how to use the system*. This training can be general (how to log on / how to navigate through the system) and/or specific (what screens, transactions and keystrokes are required to do a certain job).

ERP Education and Training Interview Guide

Primary Interview Questions

Background Information:

Name_____

Job Title_____

Years with Company_____

Company Name_____

Industry_____

Total # of Company Employees_____

Total # of 'Touch Labor' Employees_____

1. When did your company implement its Enterprise Resource Planning (ERP) system?
2. How long did the ERP implementation take – from initial ERP concepts to 'going-live?'
3. What ERP vendor did you use?
4. What was your role in this implementation?

Usage Questions:

5. What % of the processes / systems in your company are tied to the ERP system?
6. Which ERP modules does your company use?

◯	Management/Administration	◯	Inventory Management
◯	Human Resources	◯	Purchasing / Supplier Management
◯	Finance / Accounting	◯	Marketing / Customer Management
◯	Transportation Management	◯	Production
◯	Warehouse Management	◯	Engineering
◯	Other_____		

(Mark all that apply)

For all following questions, please consider your company employment structure in three levels – a base touch labor-level, a middle management-level and an executive leadership-level.

7. Do your touch labor-level (base-level) employees use the ERP system on a daily basis?

- If so, how do they interact with the ERP system on a daily basis?
- If not, what level of employee uses your ERP system on a daily basis?

Education Process-Related Questions:

Unless otherwise specified, all remaining questions refer to either the touch labor-level employees, or the lowest applicable level in your company.

This study defines education as the teaching of the business-and-people processes portion of ERP learning, for example, 'how processes will change,' 'how individual jobs will change,' or 'how employees fit into the overall process.' With this in mind, the following questions concern the education your company provided during the ERP implementation effort.

8. From an overall, change management standpoint, how did your company educate the employees on the ERP implementation in terms of:

a. What changes to business processes will occur due to the ERP system?

b. Why the changes were necessary from an overall, company viewpoint?

c. How these changes will benefit them?

9. Most companies have dramatic changes in their business processes after an ERP implementation. These changes often greatly affect employees' roles within an organization and can include, for example, going from a 'silo mentality' to an integrated view of the company. How did your company educate employees about the transformation brought about by the ERP system in terms of:

a. What new jobs or responsibilities employees will have after ERP implementation?

b. Why the employees now perform these new jobs or responsibilities?

c. How the employees' work fits into the overall business process?

10. Even the best ERP system often has 'misfits' or glitches during implementation. How did your company address the potential for these glitches in terms of:

a. Making people aware of potential glitches that could occur during the ERP implementation?

b. How employees could identify the potential glitches?

c. How the employees' could get these problems fixed?

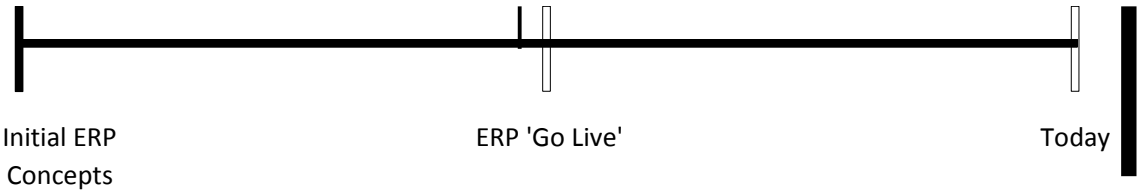
11. What methods did your company use to educate these employees?

◯ Organizational-level meetings	◯ Section-level meetings
◯ Team-level meetings	◯ Computer-based ERP education
◯ Face-to-face classroom-type education	◯ Power-Point presentations
◯ Flyers / Pamphlets	◯ Emails
◯ Bulletin boards	◯ Newsletters
◯ Other_____	

- If available, may I have some samples of these items, for example, power-point presentations, fliers or newsletter items your company used to educate employees during ERP implementation?

12. When did your company start ERP implementation education efforts?
(*Use timeline to show answer)*

- How long did this education effort last?



Education Outcome-Related Questions:

13. How successful was your company's ERP education program in terms of:

- User acceptance of the new system?
- User understanding of potential 'glitches' that occurred during implementation?
- User understanding of their new roles and responsibilities?

14. How well did the timing (start / finish) of your ERP implementation education program work for the overall implementation effort?

Education Lessons-Learned Questions:

15. From a 'people and process' education standpoint, what were the major lessons your company learned during the ERP implementation?

16. In your opinion, when is the best time to start educating employees about the ERP system?

Influence of Education Factors:

The following lists some potential education factors used during an ERP implementation. Please mark how influential, in your opinion, these factors are to the overall success of an ERP implementation.

		Influence on Overall ERP Implementation Success								
	Possible Education Factors	Very Negative Influence	↔ Between	Moderate Negative Influence	↔ Between	Not Influential	↔ Between	Moderate Positive Influence	↔ Between	Very Positive Influence
People Motivated Needs	1. Understanding How Jobs will Change	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
	2. Understanding Why Jobs will Change	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
	3. Understanding How Changes Benefit Employees	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Process Motivated Needs	4. Understanding Changes to Business Processes	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
	5. Understanding Why Business Changes are Necessary	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
	6. Understanding how End User's Job Fits into the Overall Business Processes	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Technology Motivated Needs	7. Making End User Aware of Potential for Glitches	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
	8. Explaining How Users could Identify Glitches	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
	9. Explaining How Users could Report Glitches	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
When educated:	10. ERP Education begins before implementation	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
	11. ERP Education begins while system 'going live'	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
	12. ERP Education continues after implementation	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]

Training Process-Related Questions:

This study defines training as the actions used to teach employees how to operate the ERP system (i.e. the keystroke and transaction portion of ERP learning). With this in mind, the following questions concern the training your company provided during the ERP implementation.

17. How did your company initially train the touch labor-level employees on the operation and use of the ERP system?

Who provided training:

◯	Vendor-provided	◯	In house (employee) trainers
◯	3rd Party (not ERP vendor)	◯	Other_____

Training methods used:

◯	Face-to-face 'classroom' training	◯	Computer-based training
◯	'Shadowed' Implementation Team	◯	Paper-based training
◯	Step-by-step instruction manuals	◯	On-the-job training
◯	Other_____		

(Mark all that apply)

a. Who was the primary training provider?

b. What was (were) the primary training method(s)?

c. Why was this (were these) method(s) selected?

18. Did the middle- and executive-level employees receive the same training as the touch labor-level employees?

- If no, how did the ERP training differ between the touch labor-level employees and the middle- and executive-level employees?

19. How were training manuals used to support employee training?

a. How were the training manuals created?

a. If not used, why weren't training manuals used?

20. How far in advance did your company start the pre-implementation training of your workforce on how to use the ERP system? (*Use timeline to show answer)*

- How long did this training take?

21. Did your company make changes made to the employee training process during the ERP implementation due to ERP system changes, to address gaps found in the training, or for other reasons?

- If so, what reasons caused this change?
- If so, how did your company implement the changes to the training program?
- Consider the training timeline (question 20), when did these changes to the training process happen – before, during or after implementation?

22. How closely did the pre-implementation training reflect how the actual system operated?

Training Outcome-Related Questions:

23. How successful was your company's ERP training program in terms of:

- The primary training provider used?
- The primary training methods used?
- The employee 'train the trainer' program?
- The manuals used to support employee training?
- The timing of the training – too early / too late / just right?

24. How adequate did you feel your company's ERP training was before 'going-live'?

a. After going live with the ERP system, did this feeling change?

Training Lessons-Learned Questions:

25. From a 'transaction and keystroke' training standpoint, what were the major lessons your company learned during the ERP implementation?

26. In your opinion, when is the best time to start training for the ERP system?

Influence of Training Factors:

The following lists some potential training factors used during an ERP implementation. Please mark how influential, in your opinion, these factors are to the overall success of an ERP implementation.

		Influence on ERP Implementation Success								
	Possible Training Factors	Very Negative Influence	↔ Between	Moderate Negative Influence	↔ Between	Not Influential	↔ Between	Moderate Positive Influence	↔ Between	Very Positive Influence
What:	1. Employees given job specific training	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
What:	2. Employees training limited to general ERP system use	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Who:	3. Employees given ERP vendor provided training	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
Who:	4. In house (employee) trainers used to train employees	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
How:	5. Employees 'shadow' vendor implementation team	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
How:	6. Employees given face-to-face classroom-style training	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
How:	7. Employees given computer-based training	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
How:	8. Employees given paper-based training	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
How:	9. Employees given on-the-job training	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
How:	10. Employee training supported by job specific user manuals	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
How:	11. Training program changed as ERP system changes	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
When:	12. Training conducted just prior to 'go-live' date	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
When:	13. Employees trained to use system after 'go-live' date	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
How Long:	13. Employee training is a one-time effort with a definite end	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]
How Long:	14. Employee training is a continuous effort	[-4]	[-3]	[-2]	[-1]	[0]	[1]	[2]	[3]	[4]

Implementation Outcome Questions:

27. What problems, if any, did your company experience after the ERP implementation?

- How were these problems related to your training or education programs?

28. Overall, would you consider your company's ERP implementation a success?

a. Please explain how you define this answer.

Wrap-up:

29. Is there anything you wish to add or comment on that I failed to bring up?

‘ERP User’ Interview Flow and Definition Sheet

This sheet provides an outline of the basic flow the ‘ERP User’ interview will follow and explains some non-standard terms and items from the interview guide.

Outline of Interview Flow

7. Background Information
8. ERP Education-Related Questions
    a. Methods
    b. Outcome
    c. Lessons Learned
9. ERP Training-Related Questions
    a. Methods
    b. Outcome
    c. Lessons Learned
10. Wrap-up

Non-Standard Terms and Definitions

4. **ERP Education** – As stated in the interview guide, this study considers education to be the ‘people-and-process’ portion of ERP learning. This study defines ERP education as ‘anything that *helps you understand the big picture about the ERP system*.’ For example, education includes explaining what an ERP system is, why the company is implementing the system, how the system will affect your work, etc.

5. **ERP Training** – In contrast to education, ERP training is the ‘keystrokes and transaction’ teaching that ‘*shows how to use the system*.’ This training can be general (how to log on / how to navigate through the system) and/or specific (what screens, transactions and keystrokes are required to do a certain job).

ERP Education and Training Interview Guide

'ERP User' Interview Questions

Background Information:

Name_____

Job Title_____

Years with Company_____

1. What was your job during the ERP implementation?

2. How often do you use the ERP system?

- What, if anything, does the new system do for you that the old system did not?
- What, if anything did the old system do for you that the new system can't

3. How did your job change after the ERP implementation?

Education-Related Questions:

For the next few questions, I want you to consider the 'education' you received prior to the ERP system 'going-live.' This study defines education as the 'people-and-process' portion of ERP learning. In short, education provides the 'big picture' view of the ERP system. For example, ERP education happens when you are told about changes in the system, how your role fits into the overall company, and anything about the ERP system that does not directly relate to how to use the system.

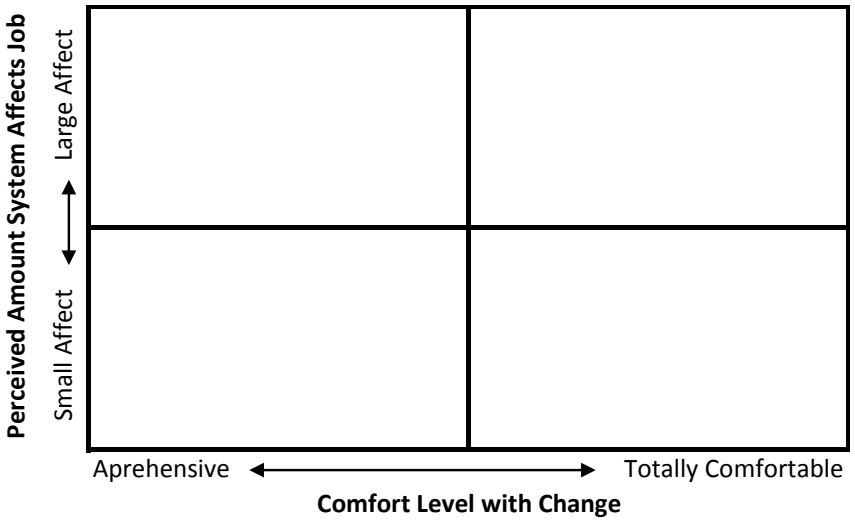
4. What methods of education did you receive before the ERP system 'went-live'?

◯	Organizational-level meetings	◯	Section-level meetings
◯	Team-level meetings	◯	Computer-based ERP education
◯	Face-to-face classroom-type education	◯	Power-Point presentations
◯	Flyers / Pamphlets	◯	Emails
◯	Bulletin boards	◯	Newsletters
◯	Other_____		

(Mark all that Apply)

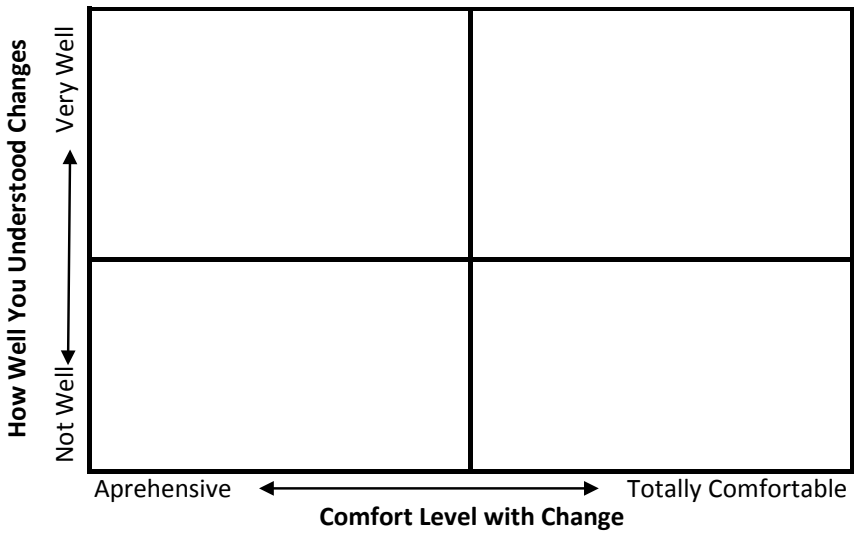
- Which of these education methods was most beneficial in helping you understand the changes that were taking place?

5. Based on the education methods your company used prior to the system 'going-live,' how did you feel the new system would affect your job? *(Please mark chart and explain your answer)*



6. One of the main benefits of an ERP system is the ability to integrate processes across the entire company. This integration often greatly affects an employee's job and responsibilities. How did your job or responsibilities change after the ERP system was implemented?

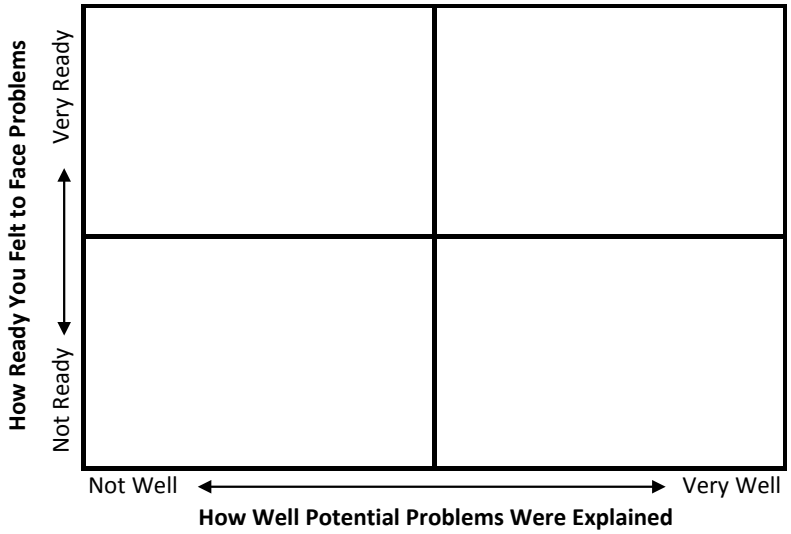
- How well do you feel your company educated you about the changes that would happen with your job? *(Please mark chart and explain your answer)*



7. How well do you feel your company educated you about how your job fits into the overall company processes? *(Please pick one answer)*

[5]	[4]	[3]	[2]	[1]
Very Well *(All aspects of how my specific job fits into the company as a whole were explained)*	← Between →	**Somewhat** *(Average, general aspects of how job fits into company explained)*	← Between →	**Not Well** *(Company did not try to explain how my job fits into the company as a whole)*

8. Often companies use education programs to prepare their employees for potential 'glitches' or problems that may occur during an ERP system's implementation. How well do you feel your company educated you about the types of problems you might face during the ERP implementation? *(Please mark chart and explain your answer)*



9. Was there anything, education-related, you felt could have been done better?

Training-Related Questions:

For the next few questions, I want you to consider the 'training' you received prior to the ERP system 'going-live.' This study defines training as the 'keystroke and transaction' portion of ERP learning. In short, training is anything that helps you learn how to use and interact with the system.

9. What types of training did you receive that helped you use the ERP system?

Training methods used:

◯	Face-to-face 'classroom' training	◯	Computer-based training
◯	'Shadowed' Implementation Team	◯	Paper-based training
◯	Step-by-step instruction manuals	◯	On-the-job training
◯	Other_____		

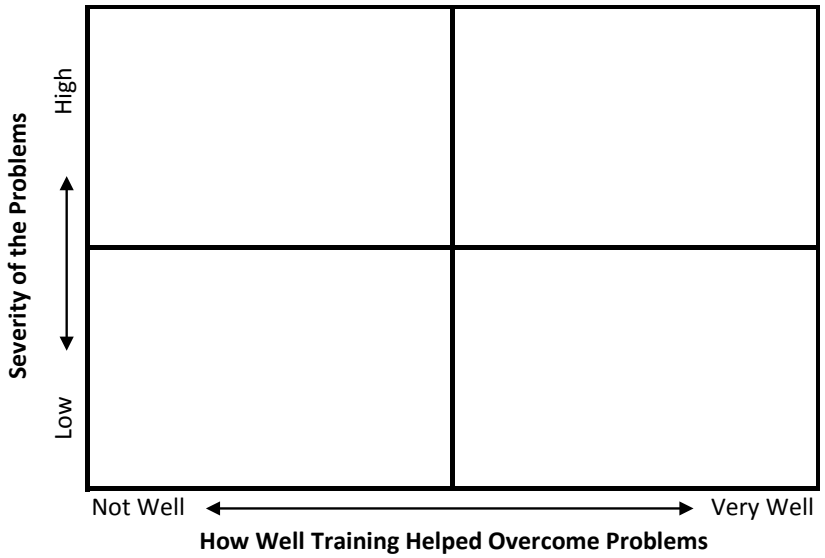
(Mark all that apply)

10. What was the most effective type of training you received on the ERP system?

- How was this training different from other ERP training you received?
- At what point was the training most beneficial; before, after, or during the 'go-live' phase?
- Who provided this training?
    - How well did this person understand your job?

11. How many problems did you experience during the ERP implementation?

- How well did your training help you overcome these problems? *(Please mark chart and explain your answer)*



- Thinking back to the education your company provided you, how many of these problems were unexpected (not talked about during education sessions)?

12. Was there anything, training-related, you felt could have been done better?

Wrap-Up:

13. Was there anything significant that happened during the ERP implementation that I did not touch upon, or that you would like to add?

Appendix D: Standard Ethics Protocol Letter

(*To be read by interviewer before the beginning of the interview. One copy of this form should be left with the respondent, and one copy should be signed by the respondent and kept by the interviewer.*)

Hi, my name is Thomas Sprague. I am a research assistant on a project entitled: ***Education and Training as part of an Expeditionary Combat Support System Implementation Strategy***.

This project is being sponsored by the Department of Operational Sciences at the Air Force Institute of Technology.

Professor _____ is the principal investigator of this project and he may be contacted at phone number _____ should you have any questions.

Thank you for your willingness to participate in this research project. Your participation is very much appreciated. Just before we start the interview, I would like to reassure you that as a participant in this project you have several definite rights.

First, your participation in this interview is entirely voluntary.

You are free to refuse to answer any question at any time.

You are free to withdraw from the interview at any time.

This interview will be kept strictly confidential and will be available only to members of the research team.

Excerpts from this interview may be made part of the final research report, but under no circumstances will your name or personally identifying characteristics be included in the report.

I would be grateful if you would sign this form to show that I have read you its contents.

_____(*signed*)

_____(*printed*)

_____(*dated*)

Please send me a report on the results of this research project (*circle one*)

YES NO

Email address for those requesting research report

(*Interviewer: keep signed copy; leave unsigned copy with respondent*)

Appendix E: Blue Dart

MSgt Thomas M. Sprague, Student, AFIT
thomas.sprague@us.af.mil
Word Count: 730

ECSS Implementation Education and Training Issues

One current venture of the United States Air Force (USAF) is the implementation of the largest ever single-instance of an enterprise resource planning (ERP) system. This project, dubbed Enterprise Combat Support System (ECSS), has the potential to integrate the USAF worldwide supply chain and make transparent the currently cloudy connections between parts, people and processes. Unfortunately, ERP implementations have many potential problems and there is no guarantee of successfully implementing ECSS unless the USAF properly manages these problems.

One problem area the USAF must manage is ERP education and training. According to the literature, this area is consistently underestimated. In addition, the education and training success factors are hard to identify and none of the reviewed literature contained a synthesis of these factors. The intent of this study was to help overcome the education and training problems by first identifying the potential education and training success factors. Then, the study tested how well the identified factors compare to the methods used by companies implementing an ERP system. Finally, the study compared the proposed USAF ECSS end user training plan to these findings to identify potential problems and help develop recommendations for the implementation team.

The general implication of the study's education and training findings are that companies must properly manage education and training programs if they desire successful ERP implementations. However, the researcher found several areas where the proposed training plan for ECSS fell short. The two biggest problems revolved around who should train and the use of computer-based training (CBT)-only as the primary end user training method.

The current plan for ECSS uses either vendor-provided trainers or CBT-only as the primary end user trainers. In-depth knowledge transfer, according to the current plan, affects only 2% of the estimated 250K end users of ECSS. While this training strategy *may* be effective at enabling end users to operate ECSS, it severely limits the USAF level of organic, in-house expertise on the system.

Both previous articles and studied companies indicated a strong need for in-house expertise and strongly linked this expertise to in-house trainers. The general plan for all studied cases was for vendors to train in-house ERP implementers who then trained in-house trainers who finally trained the end users. This strategy may not be appropriate for the USAF given the vendor, rather than in-house, implementation of ECSS. However, the USAF should consider adopting a shortened training strategy, i.e. vendors to organic USAF trainers to end users. The researcher considers this strategy superior to the current training strategy of vendor provided or CBT-only. Using this method would result in greater levels of organic USAF ECSS proficiency and greater flexibility for USAF training development and delivery to end users.

The previous articles and studied companies strongly supported using instructor-led training (ILT) as the primary end user training method. In some cases CBT was used

to prepare end users for ILT and then for refresher training after ILT. However, none of the studied cases used a CBT-only strategy as the primary end user training method. However, the current plan for ECSS is for 90% (225,000 end users) to receive CBT-only and only 10% (25,000 end users) to receive blended CBT/ILT training.

The researcher assumes that using ILT for only 25,000 ECSS end users is a cost reduction strategy. If this is not the case, the researcher recommends all ECSS subject matter experts and non-casual end users be trained via a blended method of CBT/ILT. If, as supposed, providing ILT for only 25,000 end users is a cost reduction strategy, one might expect that only the most critical end users would receive this training. However, the current plan indicates that 40% of the target ILT population (10,000) will be only casual (infrequent) users of ECSS.

The researcher strongly believes that the ILT strategy and target population requires rework and fully recommends that, given the limited number of available ILT seats, neither basic end users nor casual users be trained using ILT. Under the 25,000 user ILT constraint, the USAF should reserve ILT training for identified USAF subject matter experts and provide these users with in-depth ECSS training. In this researcher's opinion, proper use of the limited ILT seats to develop a larger pool of USAF ECSS expertise is critical to overall ECSS implementation success, even if this means reducing the overall total number of end users receiving ILT below 25,000 to accommodate a financial constraint.

Thomas Sprague is a student at the Air Force Institute of Technology.

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Vita

Master Sergeant Thomas M. Sprague graduated from York High School in Yorktown, Virginia in 1991. After a short stint working full-time while attending college part-time, he joined the USAF in early 1993. Several years later, he entered undergraduate studies at Touro University International in Cypress, California where he graduated with a Bachelor of Science degree in Business Administration in March 2005 and a Master of Arts degree in Adult Education in September 2008.

His first assignment was to the 7th Component Repair Squadron at Dyess AFB, TX as an avionics journeyman in December, 1993. During his 10 years at Dyess AFB, he served various positions including team leader, shift supervisor, dormitory manager and shop production supervisor. In August 2003, he was assigned to the 52nd Component Maintenance Squadron at Spangdahlem AB, Germany where he served as a shop production supervisor, shop chief and squadron maintenance superintendent. While stationed at Spangdahlem, he was recognized as the United States Air Force's 2005 Leo Marquez Technician/Supervisor of the Year. In August 2007, he entered the Graduate School of Engineering and Management, Air Force Institute of Technology. Upon graduation, he will be assigned to the 7th Component Maintenance Squadron, Dyess AFB, TX.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From – To)*
26-03-2009	**Master's Thesis**	Sep 2007 - Mar 2009

4. TITLE AND SUBTITLE
EDUCATION AND TRAINING AS PART OF AN EXPEDITIONARY COMBAT SUPPORT SYSTEM IMPLEMENTATION STRATEGY

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Sprague, Thomas M., Master Sergeant, USAF

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S)
Air Force Institute of Technology
Graduate School of Engineering and Management (AFIT/EN)
2950 Hobson Street, Building 642
WPAFB OH 45433-7765

8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT/GLM/ENS/09-10

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Logistics Transformation Office
Attn: John Koczak
DSN: 674-0817
WPAFB OH 45433-7765 e-mail: john.koczak@wpafb.af.mil

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

13. SUPPLEMENTARY NOTES

14. ABSTRACT
One current venture of the United States Air Force (USAF) is the implementation of the largest ever single-instance of an enterprise resource planning (ERP) system. This project, dubbed Enterprise Combat Support System (ECSS), has the potential to integrate the USAF worldwide supply chain and make transparent the currently cloudy connections between parts, people and processes. Unfortunately, ERP implementations are rife with potential problems and there is no guarantee of successfully implementing ECSS unless the USAF properly manages these problems.

One problem area the USAF must manage is ERP education and training. According to the literature, this area is consistently underestimated. In addition, the education and training success factors are hard to identify and none of the reviewed literature contained a synthesis of these factors. The intent of this study is to help overcome this problem by first identifying the potential education and training success factors. Then, using a multiple case study methodology, the study empirically tests how well the identified factors compare to the methods used by companies implementing an ERP system. Finally, the study compares the proposed USAF ECSS end user training plan to these findings to identify potential problems and help develop recommendations for the implementation team.

15. SUBJECT TERMS
ECSS, ERP, Training, Education, Implementation

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Dr. Jeffrey A. Ogden
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Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39-18